IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Suresh Ramalingam et al. Application No.: 09/874,666 Filed: June 5, 2001 For: A CONTROLLED COLLAPSE CHIP CONNECTION (C4) INTEGRATED CIRCUIT PACKAGE WHICH HAS TWO DISSIMILAR UNDERFILL MATERIALS	Examiner: David E. Graybill Art Group: 2827

APPEAL BRIEF

Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Applicants submit the following Appeal Brief pursuant to 37 C.F.R. §41.37 for consideration by the Board of Patent Appeals and Interferences. Applicants also submit herewith our check number 31555 in the amount of $620.00 to cover the cost of filing the opening brief as required by 37 C.F.R. § 1.17(f). Please charge any additional fees or credit any overpayment to our deposit Account No. 02-2666. A duplicate copy of the Fee Transmittal is enclosed for this purpose.

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I. REAL PARTY IN INTEREST

The real party in interest is the assignee, Intel Corporation.

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences known to the appellants, the appellants' legal representative, or assignee, which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 7-14, and 31-35 of the present application are pending and remain rejected. The Applicants hereby appeal the rejection of claims 7-14 and 31-35.

IV. STATUS OF AMENDMENTS

The Applicants filed an amendment on October 5, 2004, in response to a Final Office Action issued by the Examiner on July 6, 2004. The Applicants filed a Notice of Appeal on October 6, 2004. Applicants are concurrently filing a supplemental amendment to correct minor informalities in claim 35.

V. SUMMARY OF CLAIMED SUBJECT MATTER

1. Independent claims 7, 11, and 31:

A package includes a first underfill material that is attached to an integrated circuit (IC) and a substrate[1]. The package also includes a second underfill material which is attached to the substrate and the integrated circuit[2]. The second underfill material forms a circumferential fillet that surrounds and seals the edges of the IC and the first underfill material[3]. The second underfill material is made by a material which has lower adhesion properties than the material of the first underfill[4].

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[1] Specification, page 8, lines 8-10.
[2] Specification, page 8, lines 10-13.
[3] Specification, page 8, lines 13-15.
[4] Specification, page 8, lines 19-25; page 9, lines 1-2.

The substrate is initially baked in an oven to remove moisture from the substrate material[5].

2. Dependent claims 8, 9, and 10:

The first underfill material flow between the integrated circuit and the substrate under a wicking action[6]. The package may be moved through an oven to complete a flow out and partial gel of the first underfill material. The package may be continuously moved through the oven which heats the underfill material during the wicking process[7]. The second underfill material is dispensed onto the substrate along all four sides of the IC. The second material is dispensed in a manner which creates a fillet that encloses and seals the first material[8].

3. Dependent claims 12-14, 32-35:

The substrate is preferably baked at a temperature greater than the process temperatures of the remaining underfill processes to insure that moisture is not released from the substrate in the subsequent stages[9]. After the baking process, the IC may be mounted to the substrate by reflowing the solder bumps[10]. The first underfill material is heated to a temperature of 120-145°C in an oven to partially gel the first underfill material [11]. The second material may be dispensed at a temperature of approximately 80 to 120°C[12].

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. Claims 7-14 and 31-35 stand rejected under 35 U.S.C. §112, first paragraph.
2. Claims 7-14 and 31-35 stand rejected under 35 U.S.C. §112, second paragraph.
3. Claims 7, 11, and 31 stand rejected under 35 U.S.C. §112, second paragraph.
4. Claims 7-8, 10-14, and 31-35 stand rejected under 35 U.S.C. §102(b) as being anticipated by Ameen.
5. Claims 7-14, and 31-35 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Ameen as applied to the 35 U.S.C. §102(b) rejection.

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[5] Specification, page 9, lines 4-6.
[6] Specification, page 9, lines 19-21.
[7] Specification, page 10, lines 3-5, line 16-18.
[8] Specification, page 10, lines 24-25; page 11, lines 1-4.
[9] Specification, page 9, lines 6-10.
[10] Specification, page 9, lines 13-16.
[11] Specification, page 10, lines 5-10.

VII. ARGUMENTS

A. Claims 7-14 and 31-35 Have Sufficient Written Description.

In the final Office Action, the Examiner rejected claims 7-14 and 31-35 under 35 U.S.C. §112, first paragraph for insufficient written description. The Examiner states that the undescribed subject matter of the claimed invention is the limitation recited in claims 7 and 11 ("the second material being different than the first material and having a lower adhesive property than the first material"), and the limitation recited in claim 32 ("the second material being different than the first material and having a lower adhesion property than the first material").

The Examiner states that "the instant application does not describe sufficient description of a representative number of species by actual reduction to practice, reduction to drawings, or by disclosure of relevant, identifying characteristics, i.e., structure or other physical and/or chemical properties, by functional characteristics coupled with a known or disclosed correlation between function and structure, or b a combination of such identifying characteristics, sufficient to show the applicant was in possession of the claimed genus" (final Office Action, page 6). Applicants respectfully disagree for the following reasons.

The limitation "the second material being different than the first material and having a lower adhesive property than the first material" is supported in the specification on page 8 (lines 19-25) and page 9 (lines 1-2). Specifically, the specification states:

> "The first underfill material 24 may be an epoxy produced by Shin-[E]tsu of Japan under the product designation Semicoat 5230-JP…The second underfill material 25 may be an anhydride epoxy produced by Shin-[E]etsu under the product designation Semicoat 122X. The Semicoat 122X material has lower adhesion properties than the Semicoat 5230-JP material, but much better fracture/crack resistance" (Specification, page 8, lines 19-25, and page 9, lines 1-2).

An Applicant may also show that an invention is complete by disclosure of sufficiently detailed, relevant identifying characteristics which provide evidence that

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[12] Specification, page 11, lines 4-6.

Applicant was in possession of the claimed invention, i.e., complete or partial structure, other physical and/or chemical properties, functional characteristics when coupled with a known or disclosed correlation between function and structure, or some combination of such characteristics. Enzo Biochem, 323 F.3d at 964, 63 USPQ2d at 1613.

Here, the specification, as recited above, discloses the functional characteristics ("lower adhesion properties") when coupled with a known or disclosed correlation between function and structure, or some combination of such characteristics ("SEMICOAT 122X", "SEMICOAT 5230-JP"). Therefore, the disclosure is complete to satisfy the written description with request to the subject matter claimed in claims 7 and 11.

In addition, the Examiner has the initial burden of presenting by a preponderance of evidence why a person skilled in the art would not recognize in an applicant's disclosure a description of the invention defined by the chains. In re Werthen, 541 F.2d 257, 263, 191 USPQ 90, 96 (CCPA 1976). Applicants contend that the Examiner has not met this burden because the Examiner has not presented by a preponderance of evidence why a person skilled in the art of semiconductor would not recognize the description that "the Semicoat 122X material has lower adhesion properties than the Semicoat 5230-JP material". Furthermore, a general allegation of "unpredictability in the art" is not a sufficient reason to support a rejection for lack of adequate written description." MPEP 2163.04I.

B. Claims 7-14 and 31-35 Have Enablement.

The Examiner further contends that claims 7-14 and 31-35, while being enabling for the disclosed species wherein the first material is SEMICOAT 5230-JP and the second material is SEMICOAT 122X, does not reasonably provide enablement for the limitations recited by claims 7, 11, and 32 above (final Office Action, page 6, 7). The Examiner further states that "there is no disclosure that the claimed properties and functions define a particular film composition genus", and "the invention involves unpredictable chemical reactions, and absent a statement applicable to the genuses as a whole, it is indeterminable from the disclosure of the particular species what other species will work; hence, it is indeterminable what other species are members of the genus" (final Office Action, page 7). The Examiner then concludes that "[c]hemical reactivity is a most unpredictable and empirical art and it is well settled that the requirement that the claims be commensurate in scope with the enabling disclosure is particularly stringent in this area of technology", citing In re Doumani 126 USPQ 408 (CCPA 1960), In re Grant, 134 USPQ 248 (CCPA

1962), In re Fisher, 166 USPQ 18 (CCPA 1970), Mobil Oil Corporation v. W.R. Grace and Company 180 USPQ 418 (Dist. Ct, P. Connecticut, 1973), Corona Cord Tire Company v. Dovan Chemical Corporation, 192 CD 255, and In re Hawkins 174 USPQ 157.

Applicants respectfully disagree with the Examiner's contention. First, the Examiner mis-applies the enablement requirement of 35 U.S.C. §112, first paragraph. To comply with 35 U.S.C. §112, first paragraph, it is not necessary to "enable one of ordinary skill in the art to make and use a perfected, commercially viable embodiment absent a claim limitation to that effect." CFMT, Inc. v. Yielding Int'l Corp, 349 F.3d 1333, 1338, 68 USPQ 2d 1940, 1944 (Fed. Cir. 2003). The standard for determining whether the specification meets the enablement requirement was first provided in the Supreme Court decision of Mineral Separation V. Hyde, 242 U.S. 261, 270 (1916). The statute has been interpreted to require that the claimed invention be enabled so that any person skilled in the art can make and use the invention without undue experimentation. In re Wands, 858 F.2d at 737, 8 USPQ2d at 1404 (Fed. Circ. 1988). A patent need not teach, and preferably omits, what is well known in the art. In re Buchner, 929 F.2d 660, 661, 18 USPQ2d 1331, 1332 (Fed. Cir. 1991); Hybritech, Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1384, 231 USPQ 81 94 (Fed. Cir. 1986), cert. denied, 480 U.S. 947 (1987)(; and Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick Co., 730 F.2d 1452, 1463, 221 USPQ 481, 489 (Fed. Cir. 1984). The test of enablement is not whether any experimentation is necessary, but whether, if experimentation is necessary, it is undue. In re Angstadt, 537 F.2d 498, 504, 190 USPQ 214, 219 (CCPA 1976). MPEP page 2100-185.

Here, the Examiner merely asserts that there is no disclosure that the claimed properties and functions define a particular film composition genus (Applicants assume that the phrase "film composition" is a typographical error). The Examiner's assertion is not supported by a showing that if an experimentation is necessary, it is undue. The Examiner merely asserts that the invention involves unpredictable chemical reactions, and absent a statement applicable to the genus as a whole, it is indeterminable from the disclosure of the particular species what other species will work. This assertion is flawed for at least two reasons. First, the invention does not involve unpredictable chemical reactions. The adhesive property of the underfill material is well known and not a chemical reaction. This adhesive property is predictable and ascertainable by the

identification of the products that have the adhesive property, namely, Semicoat 122X and Semicoat 530-JP. Second, there is no issue of genus and species between what is disclosed and what is claimed. The claim recites "lower adhesive property" and the specification discloses "lower adhesive property". The specification further provides the product names Semicoat 122X and Semicoat 5230-JP as illustrative examples of lower adhesive property.

In order to make a rejection, the Examiner has the initial burden to establish a reasonable basis to question the enablement provided for the claimed invention. In re Wright, 999 F.2d 1557, 1562, 27 USPQ 2d 1510, 1513 (Fed. Cir. 1993); MPEP 2164.04. Applicants contend that the Examiner has not met this burden.

"[I]t is incumbent upon the Patent Office, whenever a rejection on this basis is made, to explain why it doubts the truth or accuracy of any statement in a supporting disclosure and to back up assertions of its own with acceptable evidence or reasoning which is inconsistent with the contested statement. Otherwise, there would be no need for the Applicant to go to the trouble and expense of supporting his presumptively accurate disclosure." In re Marzocchi, 439 F.2d at 224, 169 USPQ at 370. MPEP 2164.04.

Here, the Examiner did not explain why it doubts the truth or accuracy of the statement "[t]he Semicoat 122X material has lower adhesion properties than the Semicoat 5230-JP material" as provided in the specification. Furthermore, the Examiner did not back up assertions of his own with acceptable evidence or reasoning which is inconsistent with the contested statement. The Examiner merely asserts that chemical reactivity is a most unpredictable and empirical art and it is well settled that the requirement that the claims be commensurate in scope with the enabling disclosure is particularly stringent in this area of technology. This statement is flawed in many aspects. First, the adhesive property is not a chemical reactivity. The claims do not recite how to create adhesive property of the underfill material. The claims recite to use underfill material that has a lower adhesive property. Second, there is no unpredictability in selecting an underfill material having a lower adhesive property than another underfill material. In fact, the specification even provides the specific products that have these adhesive properties, namely, the Semicoat 122X and the Semicoat 5230-JP.

The Examiner then cites a series of court cases to support his contention. However, these court cases are not applicable to the issue of whether the disclosure in the specification meets the enablement requirements. These cases merely support the

observation that catalytic effects are not ordinarily predictable with certainty as discussed below.

In In re Douman, the court faces with the issue of whether rhodium and platinum are so close to each other that is obvious to substitute one for the other as a catalyst. The Court states that "[a]s pointed out by appellants, catalytic effects are not ordinarily predictable with certainty. However, the known similarity between two materials may be such that when one of them is found to be a suitable catalyst for certain purposes it will suggest the probability that the other will also be suitable. Id. at 410. The Court, therefore, merely repeats what the appellant pointed out that catalytic effects are not ordinarily predictable with certainty.

In In re Fisher, one issue presented to the Court was whether a claim is so broad that the specification lacks sufficient support description to comply with the requirements of 35 U.S.C. §112, first paragraph. The Court states that "[i]n cases involving unpredictable factors, such as most chemical reactions and physiological activity, the scope of enablement obviously varies inversely with the degree of unpredictability of the factors involved." Id. at 24.

In In re Mercier, one issue facing the court is whether it would have been obvious to substitute acetals or hemi-acetals as reactants for the esters of the prior art reference. The Court states that "[t]he unpredictability of the catalytic phenomenon has long been recognized by this court." Id. at 779. The Court further states that "[t]he adequacy of any such showing if equivalency must be scrutinized especially carefully, where it is alleged to have been obvious to substitute one starting material for another in a catalytic process. Id. at 780.

In In re Slocombe, the Court states that "catalytic effects are a particular unpredictable aspect of the art of chemistry". Id. at 744, citing In re Doumani, 281 F.2d 215, 126 USPQ 408 (1960).

In Mobile Oil, the Court states that "this Court is not unmindful that where intricate questions of chemistry are involved,..., the presumption of validity should be weighed with great care. This is especially true where catalysts are involved, because of their known unpredictability under modified changes in their environmental use." Id. at 430.

In In re Grant, the Court ruled that the Applicant is not entitled to have broad claims where the specification does not have broad statement or suggestion that all types of

sequestering agents complexed with irons are suitable as a catalytic. The Court states that since catalytic behavior is generally recognized as being predictable, it does not agree to the generic nature of the disclosure regarding sequestered iron compounds. Id. at 250.

Since these cases merely recognize the unpredictability of catalytic phenomenon, they are inapplicable to the issue of enablement because selecting an underfill material to have lower adhesive properties than another underfill material is not related to catalytic phenomena.

C. Claims 7, 11 and 31 Are Not Indefinite.

In the final Office Action, the Examiner rejected claims 7, 11, and 31 under 35 U.S.C. §112, second paragraph, for being indefinite. The Examiner states that in claim 7 and 11, the scope of the limitation "adhesive property," and in claim 31, the scope of the limitation "adhesion property" is indeterminable because there is no art recognized definition of material properties adhesive and adhesion, and these properties are not otherwise explicitly defined in the disclosure (final Office Action, page 8).

However, as argued in the previous response filed April 21, 2004, the adhesive property is a common property of material used in encapsulating by semiconductor devices. Applicants have made an effort to provide the Examiner a product description of a material in the Appendix in the response filed April 21, 2004 to show that adhesive property is a common property. This Appendix is reproduced in this Appeal Brief. The Examiner further states that there is no art recognized quantifiable material properties adhesive and adhesion, and a quantification of these properties is not otherwise disclosed. Applicants respectfully disagree. A quantification of these properties is not required to satisfy the 35 U.S.C. §112, second paragraph. The primary purpose of this requirement of definiteness of claim language is to ensure that the scope of the clams is clear so the public is informed of the boundaries of what constitutes infringement of the patent. MPEP 2173. Here, the limitation "the second material being different than the first material and having a lower adhesive property than the first material" clearly defines the boundaries of what constitutes infringement of the patent. There is no requirement that a property of a material has to be quantified for definiteness. The Examiner has not offered authority either in the MPEP or case laws to support his assertion. Furthermore, what is claimed is not the specific values of adhesion. Rather, what is claimed is the relative adhesion

between the first and second materials. The relative adhesion is a qualitative characteristic, not a quantitative one.

D. Claims 7-8, 10-14, and 31-35 Are Not Anticipated by Ameen.

In the final Office Action, the Examiner rejected claims 7, 8, 10-14, and 31-35 under 35 U.S.C. §102(b) as being anticipated by Ameen (0340492) ("Ameen"). Applicant respectfully traverses the rejection and contends that the Examiner has not met the burden of establishing a *prima facie* case of anticipation.

Ameen discloses conformal sealing and interplanar encapsulation of electronic device structures. In Ameen, the overcoat material and the undercoat material are of the same type. They are both formed from a solventless liquid polymer (Ameen, col. 3, lines 10-13; lines 25-28). In the present invention, the second underfill material is different than the first underfill material. As stated on page 6 of the Specification, the second underfill material has lower adhesion properties but much better fracture/crack resistance than those of the first underfill material.

In the final Office Action, the Examiner states that in the frame of reference wherein the integrated circuit is below the substrate, the second material has a positionally lower adhesive and adhesion property than the first material at the chip surfaces to which they are attached (final Office Action, page 13). However, the adhesion property of a material is not a function of the relative position between the two materials, or between the integrated circuit and the substrate.

E. Claims 7-14 and 31-35 Are Not Obvious Over Ameen, In View Of Admitted Prior Art, And Further In View Of Desai and Lewis.

The Examiner rejects claims 7, 8, 10-14, and 31-35 under 35 U.S.C. §103(a) as being unpatentable over Ameen in view of Applicant's admitted prior art (AAPA), and further in view of Desai and Lewis. Applicants respectfully disagree and contend that the Examiner has not met the burden of establishing a *prima facie* case of obviousness. To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or

suggest all the claim limitations. MPEP §2143, p. 2100-129 (8th Ed., rev. 2, May 2004). Applicants respectfully contend that there is no suggestion or motivation to combine their teachings and that no *prima facie* case of obviousness has been established.

1. Claims 7, 8, 10-14, and 31-35:

The Examiner rejects claims 7, 8, 10-14 and 31-35 under 35 U.S.C. §103(a) as being unpatentable over Ameen as applied to the rejection above. Applicants respectfully traverse the rejection and contend that the Examiner has not met the burden of establishing a *prima facie* case of obviousness.

Ameen does not disclose, suggest or render obvious (1) dispensing a first material to form an underfill which becomes attached to the integrated circuit and the substrate, (2) dispensing a second material to form a circumferential fillet, the second material being different than the first material and having a lower adhesive property than the first material, and (3) wherein the substrate moves within an oven while the first material flows between the integrated circuit and the substrate.

The Examiner states that Ameen discloses that adhesive and adhesion properties are result-effective variable, and it would have been an obvious matter of design choice (final Office Action, pages 13-14). Applicants respectfully disagree.

First, the Examiner failed to offer evidence in Ameen to support the contention that adhesive properties are result-effective variables and it would have been an obvious matter of design choice to select a second material having lower adhesive property than the first material. Second, since the Examiner failed to offer evidence with specific columns and line numbers to support the contention, such a conclusion can only come from reliance on common knowledge or taking official notice. However, official notice unsupported by documentary evidence should only be taken by the Examiner where the facts asserted to be well-known, or to be common in the art are capable of instant and unquestionable demonstration as being well-known. MPEP 2144.03, In re Albert, 424 F.2d 1088, 1091, 165 USPQ 418, 420 (CCPA 1970). Here, the Examiner failed to establish that a second material having lower adhesive property than the first material in the context of underfilling an integrated circuit is capable of instant and unquestionable demonstration as being well-known. Furthermore, if official notice is taken of a fact, unsupported by documentary evidence, the technical line of reasoning underlying a decision to take such notice must be clear and unmistakable. MPEP 2144.03. Here, the Examiner's line of

reasoning is ambiguous and mistaken. As discussed above, Ameen does not disclose adhesive property is result-effective variable. Even if it is disclosed, it is unclear why this can lead to the second material having lower adhesive property than the first material.

2. Claims 7, 8, 10-14, and 31-35:

The Examiner further rejected claims 7, 8, 10-14, and 31-35 under 35 U.S.C. 103(a) as being unpatentable over Ameen and in combination with Applicant's admitted prior art (AAPA). Applicants respectfully disagree and contend that the Examiner has not met the burden of establishing a *prima facie* case of obviousness.

Ameen and AAPA, taken alone or in combination, does not disclose, suggest, or render obvious (1) dispensing a first material to form an underfill which becomes attached to the integrated circuit and the substrate, and (2) dispensing a second material to form a circumferential fillet, the second material being different than the first material and having a lower adhesive property than the first material.

Ameen does not disclose any of the above elements as discussed above. AAPA merely discloses two types of materials, SEMICOAT 5230JP and SEMICOAT 122X. AAPA does not disclose, suggest or render obvious using these two materials as an underfill and a circumferential fillet.

3. Claim 9:

In the final Office Action, the Examiner rejected claim 9 under 35 U.S.C. 103(a) as being unpatentable over Ameen or the combination of Ameen and Applicant's admitted prior art ("AAPA") as applied to claim 8, supra, and further in combination with U.S Patent Application No. 6,166,434 issued to Desai ("Desai") and U.S Patent Application No. 6,020,579 issued to Lewis ("Lewis"). Applicants respectfully disagree and contend that the Examiner has not met the burden of establishing a *prima facie* case of obviousness.

Desai discloses a die clip assembly for semiconductor package. An underfill material is dispensed into the remaining space (or "gap") between the die and the substrate (Desai, col. 1, lines 65-67; col. 2, lines 1-5).

Lewis discloses a microwave applicator having a mechanical means for tuning. An applicator includes a conveyor belt passing through center openings. Such a system may

be utilized to cure or dry coat solder masks, to die attach adhesives or to underfill (Lewis, col. 8, lines 12-21).

Ameen, AAPA, Desai, and Lewis, taken alone or in any combination, do not disclose, suggest, or render obvious (1) dispensing a first material to form an underfill which becomes attached to the integrated circuit and the substrate, (2) dispensing a second material to form a circumferential fillet, the second material being different than the first material and having a lower adhesive property than the first material, and (3) wherein the substrate moves within an oven while the first material flows between the integrated circuit and the substrate.

None of them discloses (1) and (2) as discussed above. Desai merely disclose the underfill material being dispensed between the die and substrate, not the substrate moving within an oven. Lewis merely discloses a system cure soldermask or to attach adhesives, or to underfill, not the substrate moving within an oven.

Accordingly, claims 7-14 and 31-35 are distinguishable over the cited prior art references.

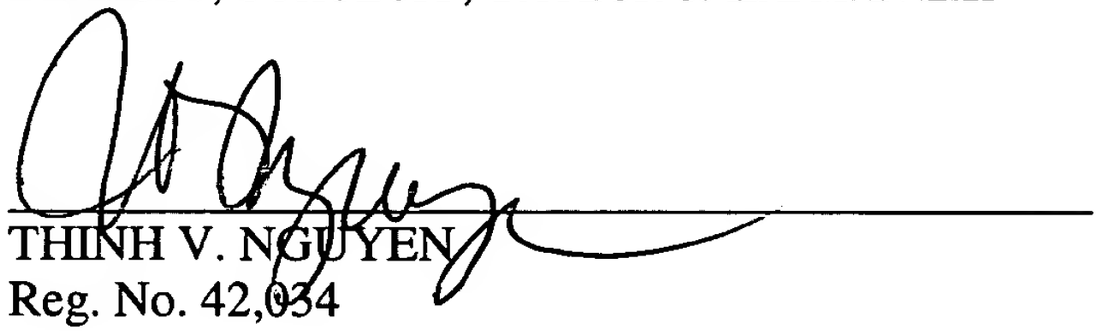
VIII. CONCLUSION

Applicants respectfully request that the Board enter a decision overturning the Examiner's rejection of all pending claims, and holding that the claims have sufficient written description, enablement, are not indefinite, and are neither anticipated nor rendered obvious by the prior art.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

Dated: January 6, 2005



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IX. CLAIMS APPENDIX

The claims of the present application which are involved in this appeal are as follows:

1.-6. (canceled)

7. (previously presented) A process for underfilling an integrated circuit that is mounted to a substrate, comprising:

dispensing a first material to form an underfill which becomes attached to the integrated circuit and the substrate; and,

dispensing a second material to form a circumferential fillet, the second material being different than the first material and having a lower adhesive property than the first material and becoming attached to the integrated circuit and the substrate.

8. (previously presented) The process as recited in claim 7, wherein the first material flows between the integrated circuit and the substrate.

9. (previously presented) The process as recited in claim 8, wherein the substrate moves within an oven while the first material flows between the integrated circuit and the substrate.

10. (previously presented) The process as recited in claim 7, wherein the second material is dispensed in a pattern which surrounds the first material.

11. (previously presented) A process for underfilling an integrated circuit that is mounted to a substrate comprising:

heating the substrate before a first material is dispensed;

dispensing the first material to form an underfill, the first material becoming attached to the integrated circuit and the substrate; and,

dispensing a second material to form a circumferential fillet, the second material being different than the first material and having a lower adhesive property than the first material and becoming attached to the integrated circuit and the substrate.

12. (previously presented) The process as recited in claim 11, further comprising heating the first material to a gel state.

13. (previously presented) The process as recited in claim 12, wherein the substrate is heated to a temperature that is greater than a temperature for heating said first material to said gel state.

14. (previously presented) The process as recited in claim 11, further comprising mounting the integrated circuit to the substrate with a solder bump before the first material is dispensed.

15.-30. (canceled)

31. (previously presented) A process for underfilling an integrated circuit that is mounted to a substrate comprising:

heating the substrate before a first material is dispensed;

dispensing the first material to form an underfill, the first material becoming attached to the integrated circuit and the substrate; and,

dispensing a second material around a periphery of the integrated circuit to form a circumferential fillet, the second material being different than the first material and having a lower adhesion property than the first material and becoming attached to the integrated circuit and the substrate.

32. (previously presented) The process as recited in claim 31, further comprising heating the first material to a gel state.

33. (previously presented) The process as recited in claim 32, wherein the substrate is heated to a temperature that is greater than a temperature for heating the first material to a gel state.

34. (previously presented) The process as recited in claim 33, wherein the first material is heated to a temperature ranging between 120 degrees Celsius to 145 degrees Celsius.

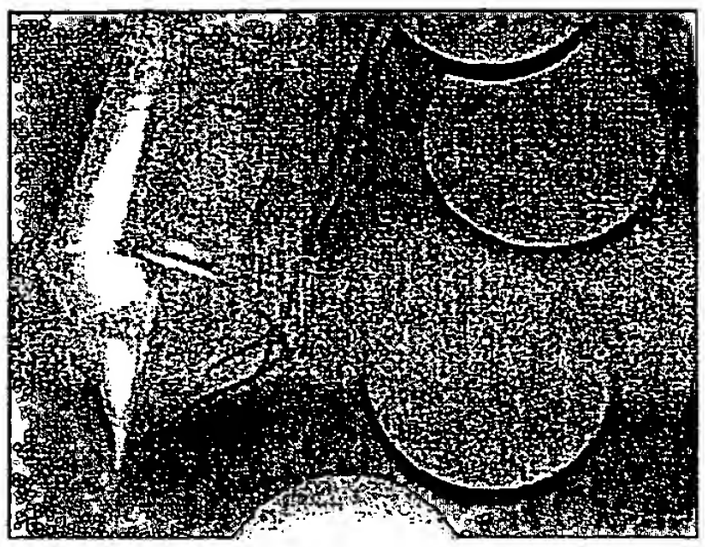
35. (previously presented) The process as recited in claim 31, wherein the dispensing of the second material is at a temperature ranting between 80 degrees Celsius and 120 degrees Celsius.

X. EVIDENCE APPENDIX

Semiconductor Materials and Production Process Materials

As a super supplier of semiconductor-related materials, we supply silicon wafers and a wide variety of materials indispensable to the manufacture of semiconductors. We also supply gases, chemicals, fixtures, etc. for use in production processes.

[Semiconductor materials]



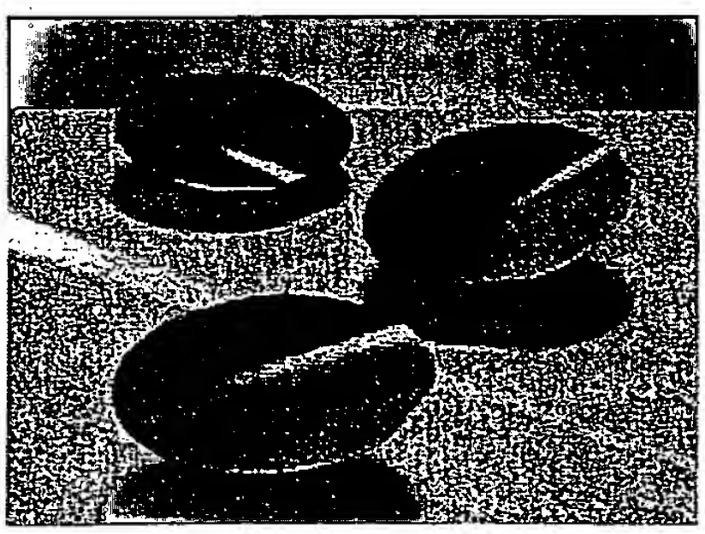
300mm silicon wafers

For inquiry 8

With the arrival of the era of full-scale mass production of 300mm wafers, customers' expectations on silicon wafers are increasingly high. As a pioneer in the world silicon market, Shin-Etsu Handotai (SEH) took the head start of the mass production of 300mm and has established a system ensuring a stable supply to the market. In responding to even higher requirements from the customers for the future, we continue the incessant efforts and challenges for the quality improvements.

Features
- ①We have respond to the growing market demand in timely manner with our capacity expansions since the starting of the mass production in February 2001.
- ②Our products can meet the 0.13um design rule process and beyond.
- ③Our product portfolio covers wide range of the customers' various requirements.

Applications ①Substrates for memory devices, microprocessor devices, etc.



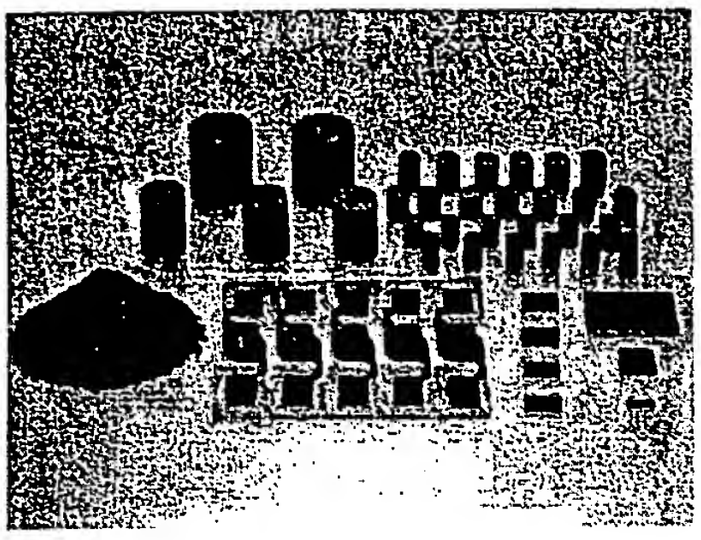
IG-NANA wafers

For inquiry 8

IG-NANA wafers (annealed wafers) can be used in wide range of device processes, from high-temperature processes to low-temperature processes. This product can provide high device performances at a reasonable cost.

Features
- ①Enhancement of the "getter effect" is achieved with the presence of highly-densed and highly uniformed BMD in the bulk.
- ②The surface layer is defect-free.
- ③Suitable for advanced technology processes with narrow design rule
- ④Available also in 300mm

Applications ①Substrates for memory devices, logic devices, etc.



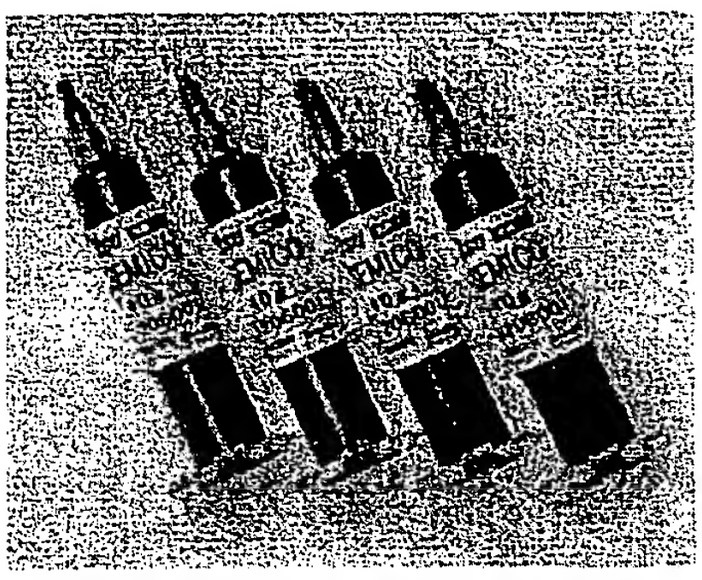
Epoxy molding compounds

For inquiry 6

These encapsulating materials provide low stress, low alpha-ray property and high thermal conductivity.They are also environment-friendly.

Features
- Superior moisture resistance, electrical characteristics, and moldability. This material meets the high requirements for resin encapsulation of devices.
- By introducing a new, original flame-retardant system, this product is free from halogen and antimony trioxide.

Applications
- D-RAM and other LSI molding, full pack molding for power devices etc.



Liquid epoxy encapsulating materials

For inquiry 6

This is a liquid epoxy resin encapsulating material for the protection and adhesion of semiconductor devices.

Features
- Excellent low stress, adhesive, and penetration property

Applications
- Under filling, COB potting, hermetic seal, and other uses for electrical or mechanical protection and highly reliable adhesion of semiconductor devices

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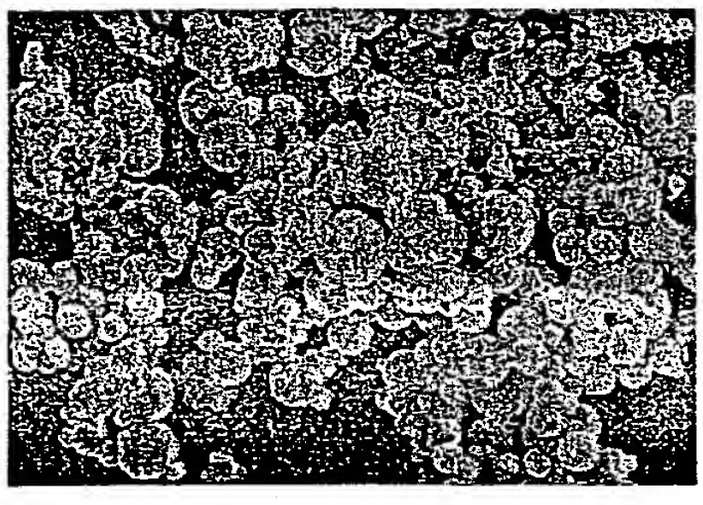


True spherical shape ultra-fine particulates "ADMAFINE"

For inquiry 19

ADMAFINE is true spherical shape ultra-fine particulates produced using a special process of oxidize metallic powder. Admatecs, a joint venture of Toyota Motor, Shin-Etsu Chemical, Shin-Etsu Quartz Products and Tatsumori, succeeded in commercial production of this product as a pioneer in the world.

Features
- The true spherical shape ultra-fine particulates have a sharp granular distribution, capable of improving the toughness, flowability, thermal conductivity and other physical properties of composite materials.
- Not only simple oxide but also of composite oxide fine spherical particulates can be produced.
- It is possible to coat the particles with various types of composites or classify the particles.

Applications
- Filler material for semiconductor enclosure applications
- Filler material for precision resin molding applications
- Anti-blocking materials
- Sintering materials

For More Information

Shin-Etsu
http://www.shinetsu.co.jp/

	Division / Dept.	Phone	Homepage
1	Silicone Division Sales and Marketing Dept. III	+81-3-3246-5101	
2	Silicone Division Sales and Marketing Dept. IV	+81-3-3246-5152	http://www.silicone.jp/
3	Silicone Division Sales and Marketing Dept. IV	+81-3-3246-5153	
4	Electronics Materials Division Rare Earths & New Materials Dept.	+81-3-3246-5252	
5	Electronics Materials Division Magnet Dept.	+81-3-3246-5246	http://www.shinetsu-rare-earth-magnet.jp/
6	Electronics Materials Division Organic Electronics Materials Dept.	+81-3-3246-5231	
7	Advanced Materials Division Opto-Electronics Materials Dept.	+81-3-3246-5222	
8	Semiconductor Materials Division	+81-3-3217-1300	
9	Organic Chemicals Division Cellulose & Pharmaceutical Excipients Dept.	+81-3-3246-5261	http://www.metolose.jp/
10	PVC Division Chlor, Alkali & Derivatives Dept.	+81-3-3246-5081	
11	International Division	+81-3-3246-5311	http://www.shinetsu-fcl.jp/
12	New Functional Materials Department I	+81-3-3246-5346	
13	New Functional Materials Department II	+81-3-3246-5346	
14	New Functional Materials Department III	+81-3-3246-5345	http://www.sifel.jp/
15	Shin-Etsu Handotai Co., Ltd.	+81-3-3214-1836	
16	Shin-Etsu Polymer Co., Ltd. Electronics Material Handling Products Division	Silicon wafer carrier and semiconductor material container +81-48-652-6290 Carrier tapes +81-48-652-6040	http://www.shinpoly.co.jp/
17	Shin-Etsu Polymer Co., Ltd. Connector Division	+81-48-652-5913	http://www.shinpoly.co.jp/business/connector/
18	Shin-Etsu Polymer Co., Ltd. RC Division	+81-48-652-5912	http://www.shinpoly.co.jp/
19	Shin-Etsu Quartz Products Co., Ltd.	+81-3-3348-1913	http://www.sqp.co.jp/
20	Shin-Etsu Film Co., Ltd.	+81-3-3259-1061	http://www.shinetsu-film.co.jp/
21	Shinano Electric Refining Co., Ltd.	+81-3-5298-1601	

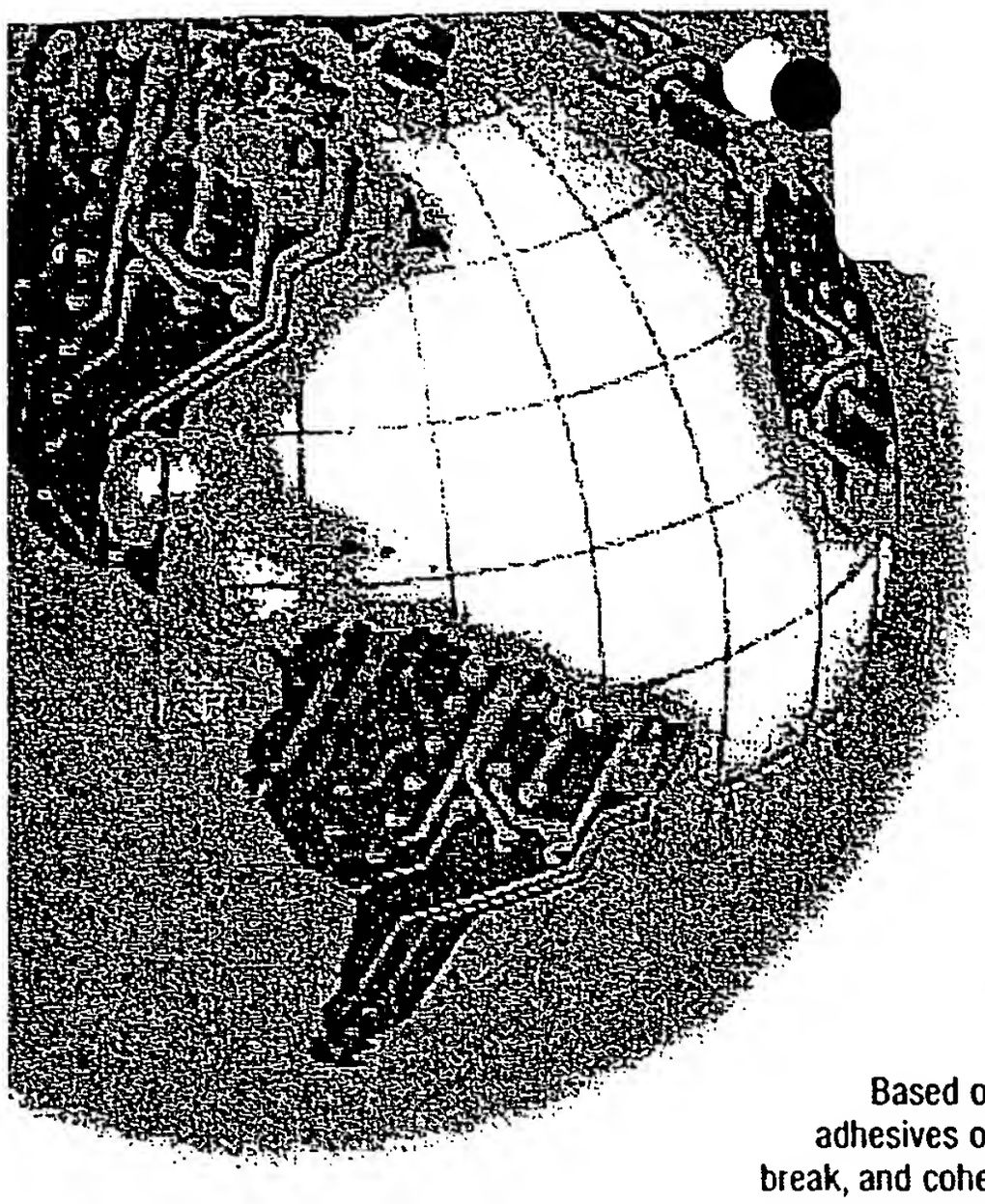
SEMICONDUCTOR

Potting for PGA, BGA etc.

Product Name			SEMICOAT 114	SEMICOAT 115	X-43-5012A	SEMICOAT 122	SEMICOAT 124*1
Feature			Low viscosity	Low viscosity Low stress	Low stress Good Adhesion	Low stress Small warpage	Low stress Flame resistance
Aspect Ratio*			0.10	0.05	0.05	0.05	0.05
ITEM		UNIT					
Appearance			Black	Black	Black	Black	Black
Viscosity	25℃	poise	55	400	1000	400	900
Gelation Time	150℃	sec	60	70	70	60	70
Flexural Strength	25℃	kgf/mm²	8	10	10	11	10
Flexural Modulus	25℃	kgf/mm²	450	1100	1300	1300	1000
Coefficient of Thermal Expansion	$\alpha 1$	ppm/℃	45	20	15	15	20
	$\alpha 2$	ppm/℃	140	80	60	60	80
Glass Transition Temp.		℃	135	145	145	155	145
Volume Resistivity at 25℃		Ω cm	2×10^{16}	2×10^{15}	2×10^{16}	2×10^{16}	1×10^{16}
Dielectric Constant at 1kHz			4.0	3.5	3.3	3.6	3.5
Recommended Cure Condition			100℃/1Hr+150℃/1Hr	100℃/0.5Hr+150℃/2Hr	100℃/0.5Hr+150℃/2Hr	100℃/1Hr+150℃/2Hr	100℃/0.5Hr+150℃/2Hr
Dispense Condition(Device Temp.)		℃	22～50	*70～90	*70～90	*70～90	*70～90
Storage Condition		℃	Below－5	Below－5	Below－5	Below－40	Below－5

* to avoid trapping air in dispense process.

*1 UL94V-0 recognized component



Hysol® Die Attach Adhesives

Elevated lead-free processing temperatures demand electronic packaging materials that can withstand polymer decomposition during reflow, increased interfacial stresses, and loss of adhesive and cohesive strength.

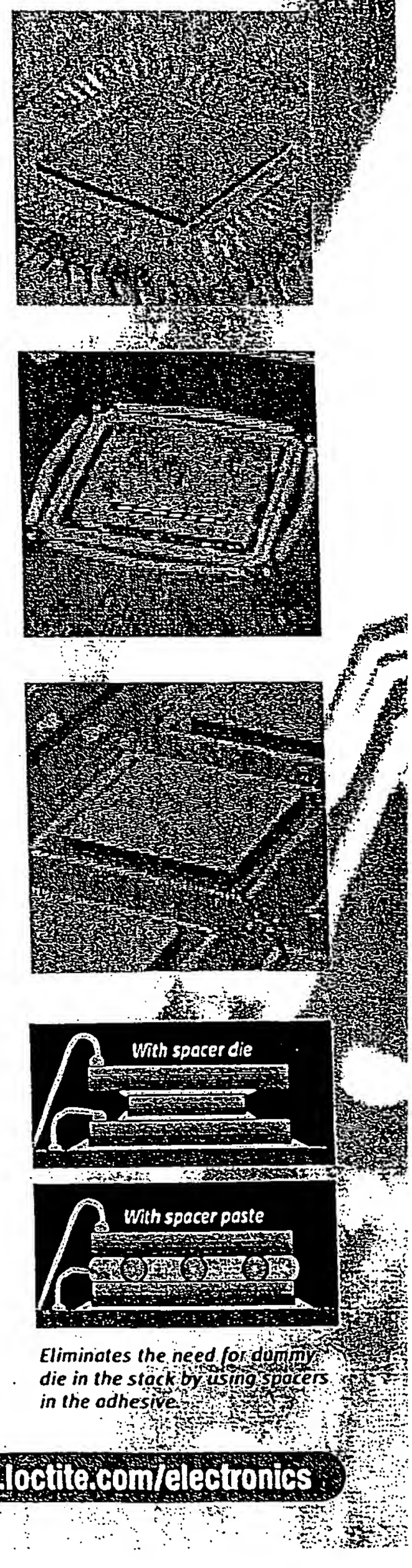
Based on ultra-hydrophobic chemistry, Hysol® die attach adhesives offer very high adhesive strength, elongation at break, and cohesive energy at high reflow temperatures. These properties help electronic packages retain adhesive strength and structural integrity during moisture soak and absorb stresses during the deformations associated with lead free reflow processing.

Designed to deliver superior quality and reliability, Hysol® die attach adhesives have won a number of supplier quality awards. Several products are formulated with PTFE, an extremely low dielectric constant material that will not abrade polyimide and other die passivation.

Our fast reaction kinetics and solvent-free formulation enables inline SkipCure™ processing that increases UPH for adhesive cure, eliminates the need for separate curing equipment, and decreases package warpage. Our adhesives for organic substrates eliminate substrate prebaking, while our patented polymeric spacers deliver consistent bondline thickness, reduce tilt, and enable high UPHs for die placement.

With our products, our customers can use conventional oven cure as well as snap cure, and when they are ready, they can also Skipcure and SkipPrebake[1]. Our organic products can also be converted to their CCSP™ (controlled collapse spacer paste) versions without changing the base paste properties. The ability to exercise these three options, Skipcure, SkiPrebake[1], and Spacers at zero or minimal switching costs allow lower cost of use and lower cost of ownership for our customers equipment.

[1] *For products designed for organic laminates*



Eliminates the need for dummy die in the stack by using spacers in the adhesive.

Hysol® Die Attach Adhesives for Non-Hermetic Packages

For organic substrates including laminates, array, BGA and CSP packages

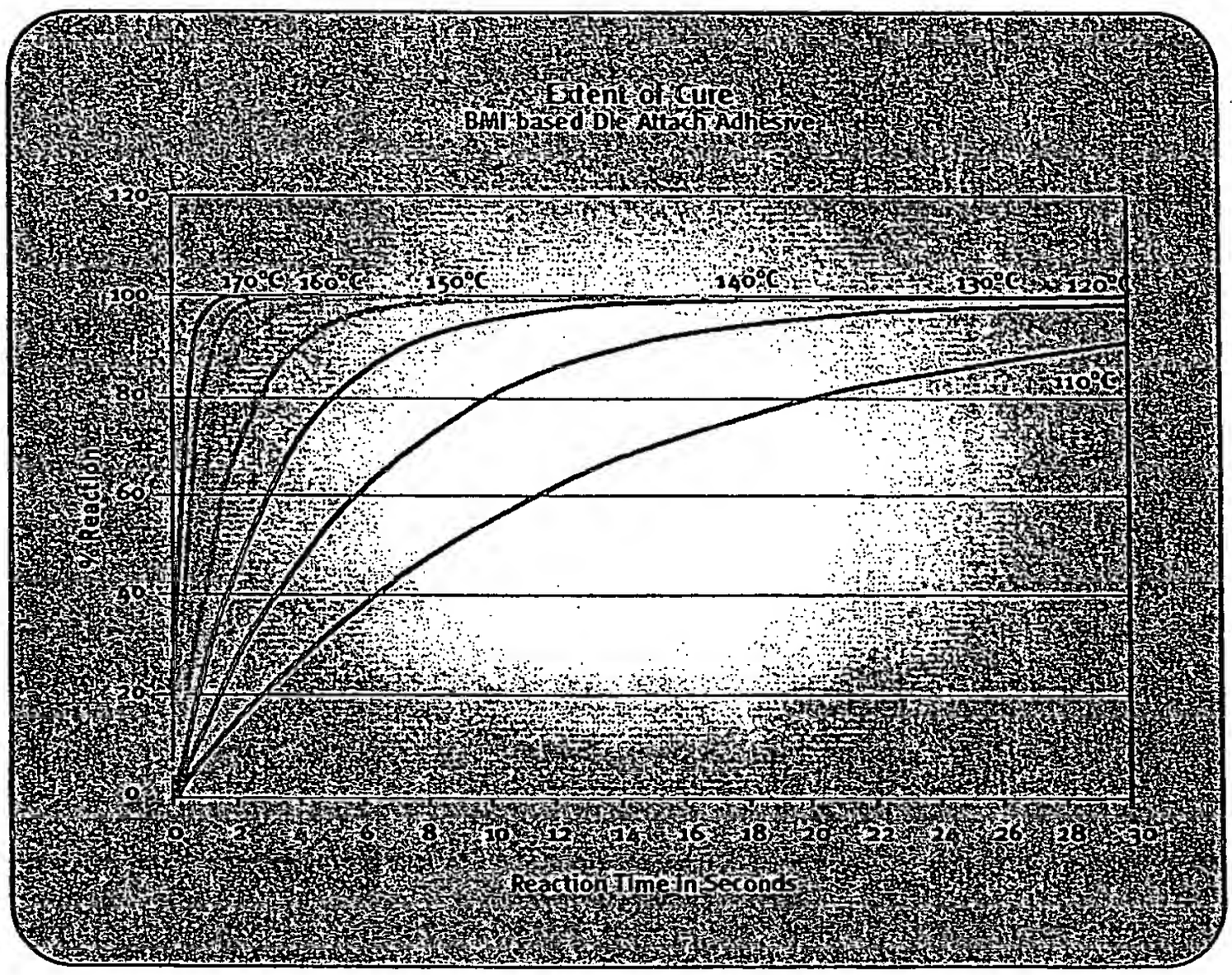
Materials	Description/Application	Resin	Filler	Oven Cure /SkipCure®	Viscosity 5rpm@ 25°C	Thermal Conductivity	Tg* (°C)	CTE α1/α2	Modulus @ 25°C	Storage Temp.
QMI 550	Stacked Die in CSP, BGA Dielectric, very high adhesive and cohesive strength and elongation at Pb-free reflow temperatures	BMI	PTFE	15 min. @ 150°C Oven 10 secs. @ 150°C SC	11500 cps	0.2 W/m°K	10	91 150	1.0 GPa	-40°C
QMI 536	Industry Standard De facto industry standard for die-to-die bonding; dielectric, high adhesive strength material for organic substrates	BMI	PTFE	15 min. @ 150°C Oven 10 secs. @ 150°C SC	9000 cps	0.3 W/m°K	-31	93 174	0.30 GPa	-40°C
QMI 536HT	High Thermal Version of QMI 536 Dielectric, high thermal conductivity adhesive for organic laminates and die-to-die bonding; ideal for mixed stacked die applications	BMI	Boron Nitride	15 min. @ 150°C Oven 10 secs. @ 150°C SC	13000 cps	0.9 W/m°K	-4	66 172	0.85 GPa	-40°C
NEW! QMI 550SI	Low CTE Version of QMI 550 Silica-filled for low shrinkage and low warpage on laminate and flex substrates	BMI	Silica	15 min. @ 150°C Oven 10 secs. @ 150°C SC	17000 cps	0.6 W/m°K	33	43 91	1.50 GPa	-40°C
NEW! QMI 550EC	Electrically Conductive Silver-filled version of QMI 550, very high adhesive and cohesive strength	BMI	Silver	15 min. @ 150°C Oven 10 secs. @ 150°C SC	17000 cps	3.8 W/m°K	~25	56 148	2.8 GPa	-40°C

For inorganic substrates including Cu, Pd, Ag & Au plating, ceramic, and black oxide

Materials	Description/Application	Resin	Filler	Recommended Cure	Viscosity 5rpm@ 25°C	Thermal Conductivity	Tg* (°C)	CTE α1/α2	Modulus @ 25°C	Storage Temp.
QMI 519	JEDEC L1 260C for SOIC, QFN De factor industry standard for QFN packages. Good for all preplated leadframes and bare copper. Higher adhesion, excellent electrical and thermal performance	BMI	Silver	15 min. @ 185°C Oven 10 secs. @ 200°C SC	9000 cps	3.8 W/m°K	45	40 140	5.3 GPa	-40°C
NEW! QMI 519HT02	High Thermal Conductivity Very high electrical and thermal conductivity while maintaining excellent adhesion. Suitable for high heat dissipating devices.	BMI	Silver	15 min. @ 185°C Oven 10 secs. @ 200°C SC	18800 cps	7.3 W/m°K	49	42 104	6.70 GPa	-40°C
QMI 505MT	For Pd, Alloy 42, Au and Black Oxide Similar to QMI 519 but with superior adhesion to palladium, alloy 42, gold and black oxide finishes	BMI	Silver	15 min. @ 185°C Oven 10 secs. @ 200°C SC	12100 cps	2.0 W/m°K	~10	77 170	0.86 GPa	-40°C
QMI 518	Electrically Conductive, Large Die Similar properties to QMI 519, but formulated to have a low modulus to reduce stress on die larger than 500 x 500 mil/13x13 µm	BMI	Silver	15 min. @ 180°C Oven 10 secs. @ 200°C SC	8500 cps	1.4 W/m°K	-64	69 152	0.10 GPa	-40°C
QMI 534	Non-Conductive, Small Die Non-conductive, very high adhesive strength on metal substrates for die sizes less than 500 x 500 mil/13x13 µm	BMI	PTFE	15 min. @ 175°C Oven 10 secs. @ 200°C SC	9000 cps	0.4 W/m°K	~35	87 171	0.30 GPa	-40°C
QMI 538	Non-Conductive, Large Die Non-conductive, very high adhesive strength on metal substrates for die sizes greater than 500 x 500 mil/13x13 µm	BMI	PTFE	15 min. @ 175°C Oven 10 secs. @ 200°C SC	8500 cps	0.3 W/m°K	-70	85 149	0.10 GPa	-40°C
QMI 536UV	UV Cure, CCD/CMOS Glass Lid Sealing Non-conductive, UV curing resin with excellent adhesion to glass. Ideal for glass lid sealing CCD or CMOS lenses	BMI	PTFE	1 min. @ 100mW/cm2	6700 cps	0.3 W/m°K	~26	62 136	0.7 GPa	-40°C
QMI 282HT	Non-conductive, Ultra Low Stress Very low modulus silicone with good thermal properties for low stress, high temperature applications.	Silicone	Alumina & Zinc Oxide	30 min. @ 150°C or 1hr. @ 120°C (No SkipCure)	49400 cps	1.0 W/m°K	-40	N/A 104	0.004 GPa	5°C+/-3°C
K00125	General Purpose Silver Epoxy Silver-filled epoxy for general bonding purposes that require electrical and thermal conductivity	Epoxy	Silver	10 min. @ 165°C (No SkipCure)	9200 cps	2.1 W/m°K	~95	65 130	4.0 GPa	-40°C

Hysol® Die Attach Adhesives for Hermetic Packages

Materials	Description/Application	Resin	Filler	Recommended Cure	Viscosity 5rpm@ 25°C	Thermal Conductivity	Tg* (°C)	CTE α1/α2	Modulus @ 25°C	Storage Temp.
QMI 301	Solder and seamed sealed packages. Low temperature cure material with very high adhesion and >340°C temperature resistance for solder-sealed hermetic packages.	Cyanate Ester	Silver	10 min @ 150°C	11400 cps	1.9 W/m°K	245	15 185	6.9 GPa	-40°C
QMI 2419	No-dry Ag glass die attach for glass-sealed packages. Very high thermal conductivity and >450°C temperature resistance.	Glass/Solvent	Silver	See ramp profile 7-10 min @ 420-460°C	37500 cps	>60 W/m°K	300	21 N/A	15.1 GPa	RT on Rollers
QMI 2569	No-dry Ag glass die attach for glass, solder, and seamed sealed packages. Very high thermal conductivity and applications for die as large as 0.800 square.	Glass/Solvent	Silver	See ramp profile 7-10 min @ 360-440°C	35800 cps	>60 W/m°K	250	16 N/A	15.1 GPa	RT on Rollers
QMI 3555R	No-dry Ag glass die attach for glass, solder, and seamed sealed packages. Very high thermal conductivity and >450°C temperature resistance for glass-sealed hermetic packages.	Glass/Solvent	Silver	See Ramp Profile 7-10 min@ 300-450°C	40000 cps	>80 W/m°K	150	16 N/A	11.5 GPa	RT on Rollers

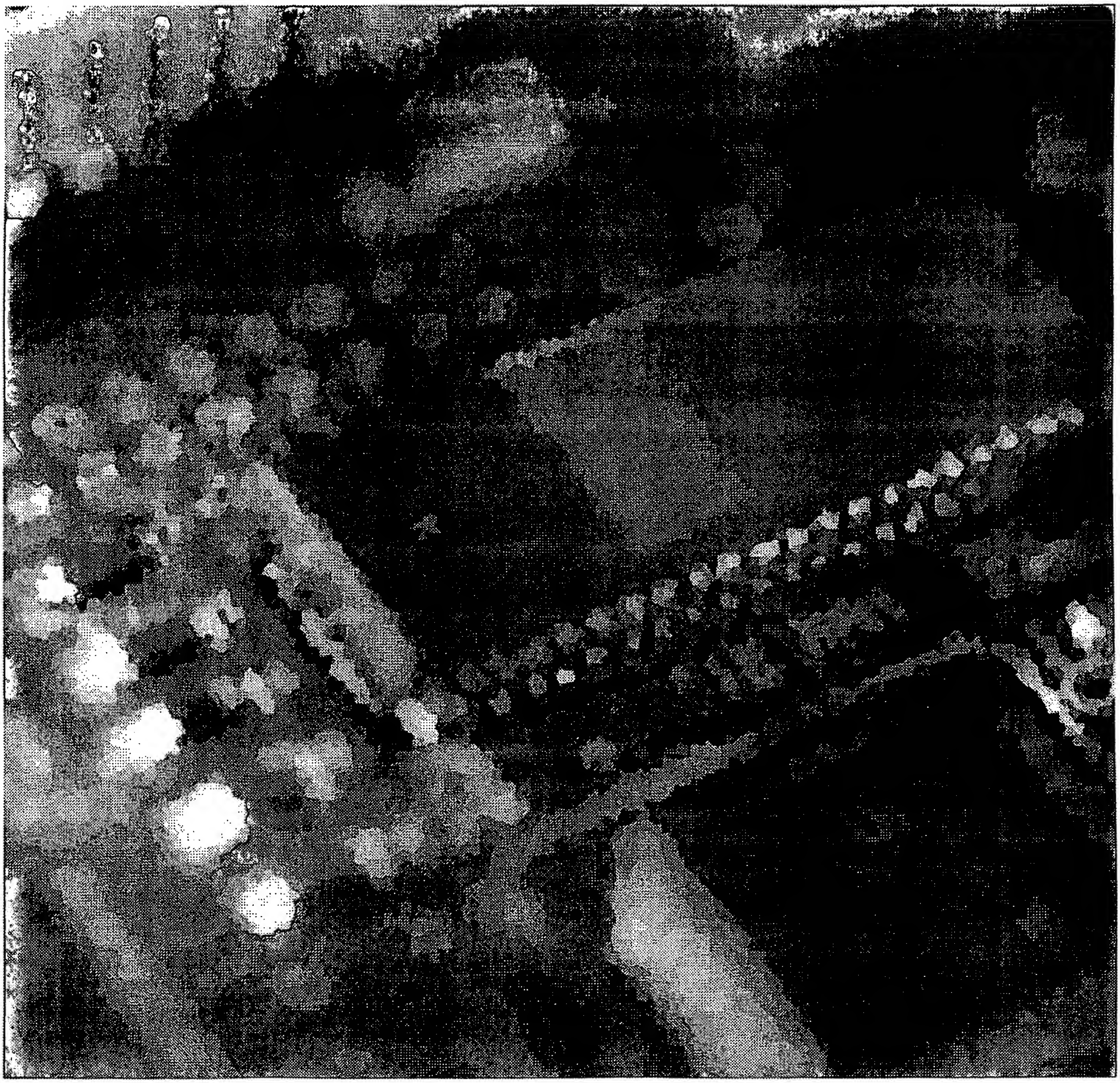


All Hysol® QMI 500 series die attach adhesives use free radical cure, enabling extremely fast cure rates (Fig.1). Adhesives in this series cure in seconds at the appropriate temperature, instead of minutes or hours. This feature allows the adhesives to be cured in-line right on the diebonder, immediately after the substrate is indexed onto the post-bond cure station or on the wirebonder preheater. This enables high UPH which translates to low total cost-of-use. SkipCure also improves the quality of the cured part. Because the substrate is held down flat during die attach cure, the resulting substrate warpage is much lower than on oven-cured substrates. Furthermore, the short distance between bondsite and post-bond cure station minimizes adhesive slump and die movement before cure, allowing more consistent bondline thickness.

Shin-Etsu

Shin-Etsu Liquid Coating Materials for Electronic Devices

KJR Series & SEMICOAT Series

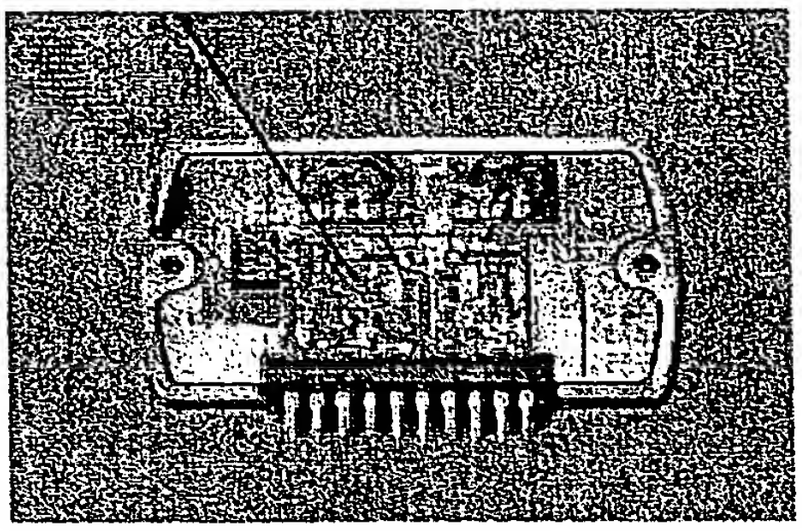


KJR Series

Junction Coating Resins
Liquid Type Silicone & Polyimide Silicone for Electronic, Electric and Optical Devices

Main Features

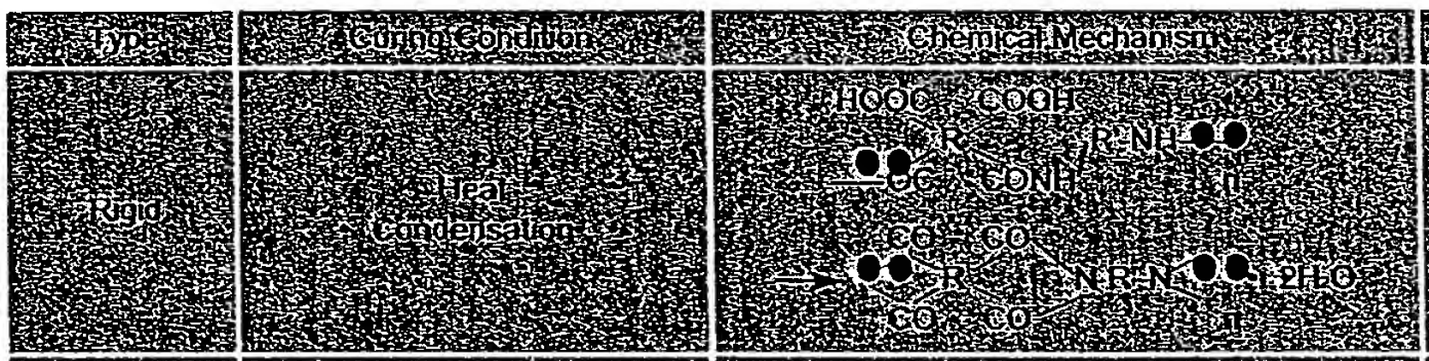
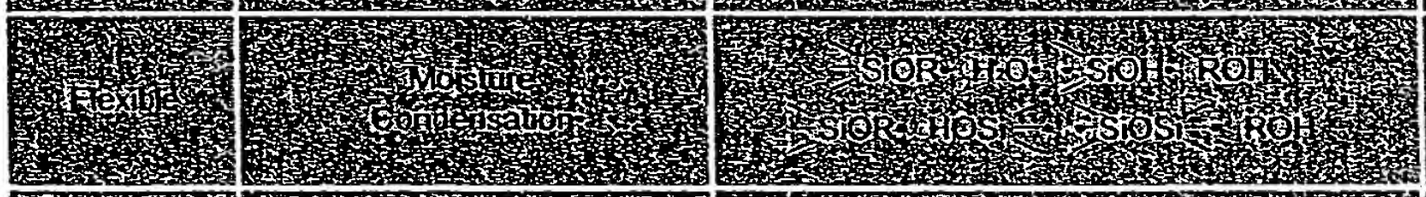
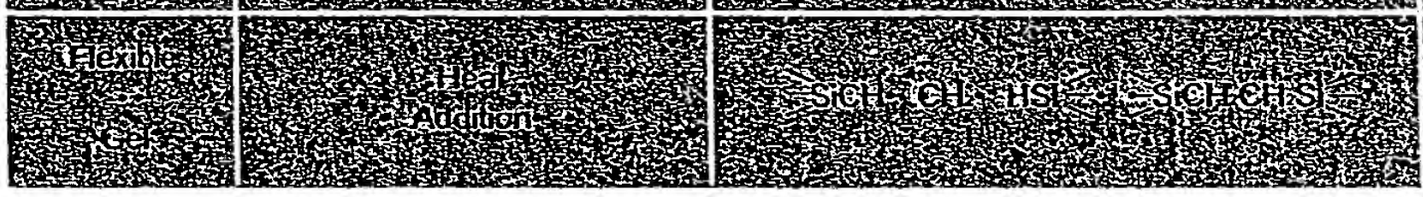
- Ultra High Purity
- High Thermal Stability
- High Electrical Stability
- High Mechanical Stability
- Excellent Adhesive Strength



Classification of KJR Series

The KJR Series can be classified into three categories according to the chemical curing mechanism used. The manufacturing process or some characteristic of the devices to be coated may dictate which group you select for particular application.

Chemical Curing Mechanisms

Type	Curing Condition	Chemical Mechanism	By Product	Grade
Rigid	Heat Condensation		H_2O	KJR650E Series Polyimide Silicone
Flexible	Moisture Condensation		ROH	KJR4000E Series Silicone
Flexible Gel	Heat Addition		None	KJR9000E Series Silicone

Rigid Type

After curing, this coating film hardens to a highly rigid polyimide.
Since it is also has excellent adhesive properties, it is ideal for coating of particularly high voltage resistant devices.

Flexible Type

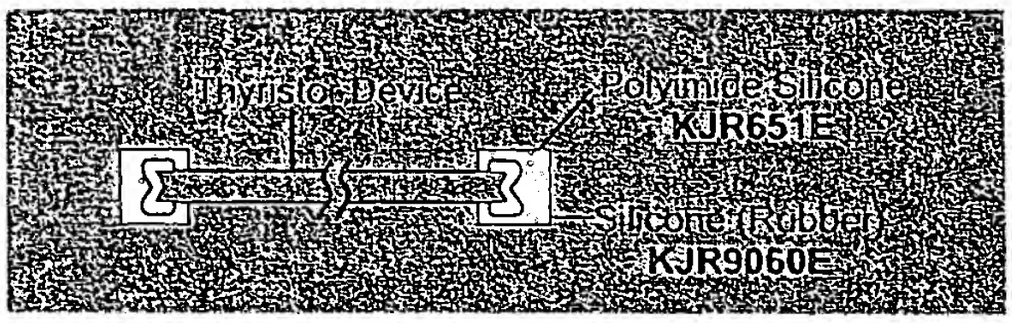
After curing, this coating film has outstanding rubber elastic properties.
By absorbing stress due to external forces, it can prevent fracturing of devices or breakage of bonding wires.

Gel Type

After curing, this coating film is a soft gel type of material.
It has extremely low stress compared with the rubber type, so maximum buffer effect can be achieved.
Since it has superb adhesion strength and lead sealing, it can provide the best humidity protection.

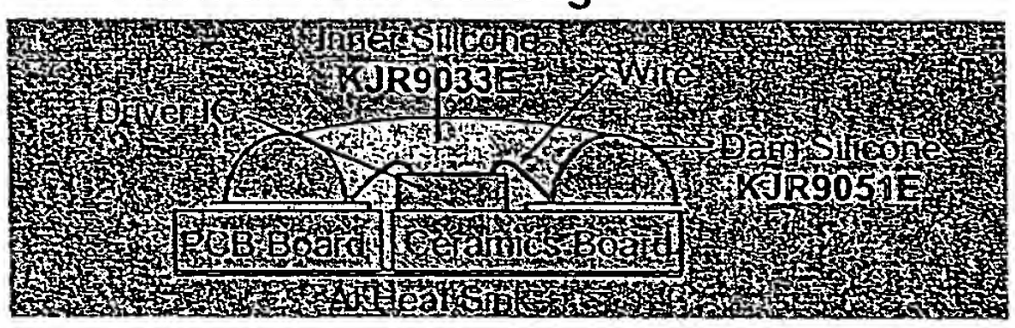
Typical Application of KJR Series for Various Devices

- a. GTO Thyristor Coating

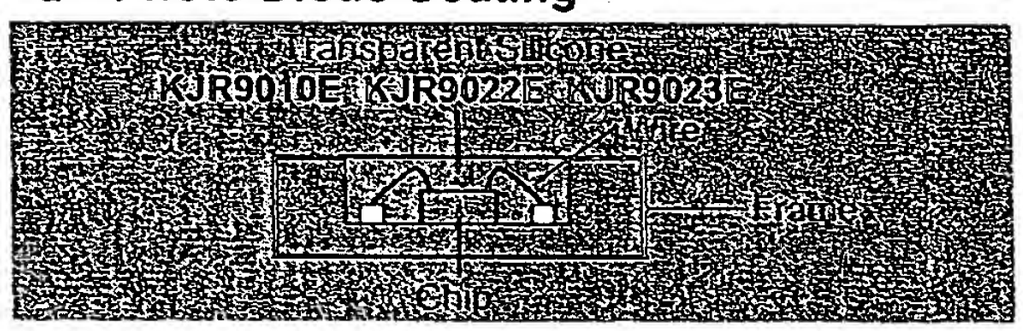


- b. Hybrid IC Chip Coating

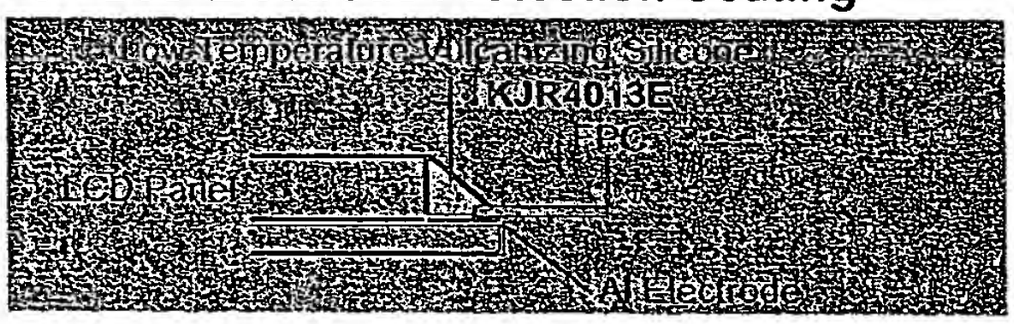
- c. Thermal Head Coating



- d. Photo Diode Coating



- e. LCD Electrode Protection Coating



Curing KJR Series Resins

The KJR Series resins maintain primarily two types of curing schedules• heat curable, and moisture curable. The heat curable type material requires a heat cure of 150• •to 170• •for one to four hours. Our moisture cure material requires more than 40 percent relative humidity for 24 hours at room temperature.

In most cases, post-curing is also required to obtain optimum properties with the greatest resistance to temperature extremes and improved reliability of coated devices.

Several of the KJR-9010E Series will remain in a gel state and do not require post-curing.

Type	Product Name	Cure Condition	Post Cure Condition
Flexible	9051E, 9052E	80• 400• /1• 4Hr	200• /4• 6Hr
	9022E, 9023E, 9050E	100• 450• /0• 4Hr	200• /4• 6Hr
	9033E, 9060E, 9061E	150• 470• /1• 4Hr	200• /4• 6Hr
	4010E, 4013E, 4012E, 4050E	20• 25• /45• 65• RHD/24Hr 150• 450• /1• 4Hr	200• /4• 6Hr
Gel	9010E, 9015E	100• 450• /1• 4Hr	200• /4• 6Hr
	9014E, 9017E	150• 470• /1• 4Hr	200• /4• 6Hr
Rigid	651E, 654E	150• /1Hr, 200• /1Hr, 250• /4Hr	300• /0.5• /4Hr
	653E	150• /1Hr, 200• /16Hr	250• /0.5• /4Hr

KJR Series

Reduced Impurities, Higher Stability for Superior Semiconductors

Impurity

Very Low Ionic Impurity Reduces Risk of Corrosion

KJR Series resins are extremely pure, offering superior stability to all types of semiconductor devices. The most critical impurity, chloride ion, is kept to an absolute minimum, greatly reducing the risk of electrode corrosion.

Ionic Impurities ppm

Grade \ Ion	Na	K	Cl
KJR Series	0.1	0.2	1.0
General Silicone	0.5	5	5 - 40

Low Uranium Content for Alpha Particle Sensitive Devices

The low uranium content of KJR Series resins is an important feature in improving the performance of devices.

Content of Uranium ppb

Product	Uranium Content
KJR Series	Undetective
KJR651E	Undetective
Synthetic Quartz	1.0
Natural Quartz	80

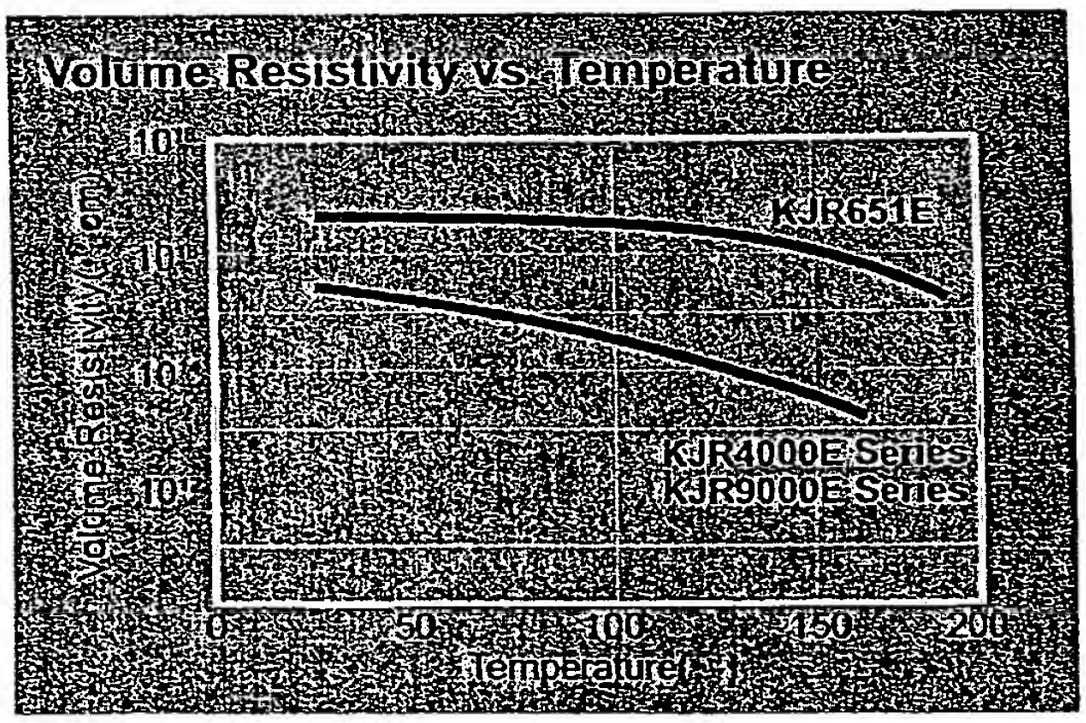
Fluorometric Method

Electrical Stability

Electrical Stability over a Broad Temperature Range

At high and low temperature extremes, KJR Series resins maintain electrical stability, due to the combination of basic organo-siloxane bonding and the low content of ionic impurities. The result is a more reliable device that operates safely in a wide variety of conditions, even at very high temperatures.

The KJR651E, a copolymer structure composed of polyimide and polysiloxane, possesses superior high temperature properties.

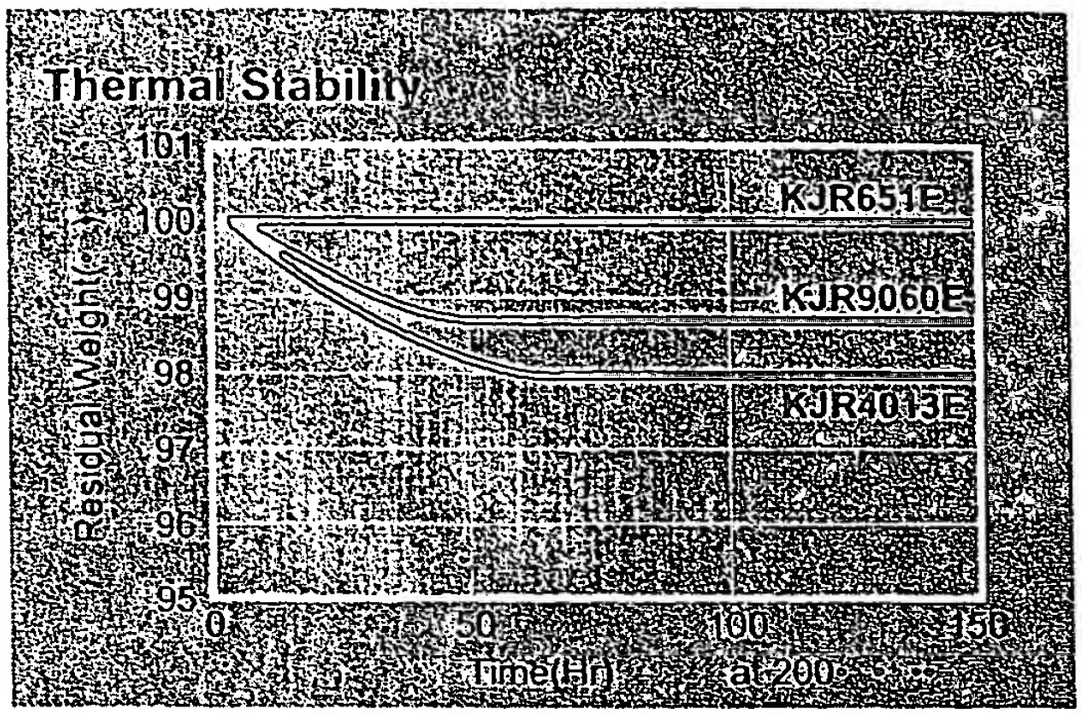


Thermal Stability

Thermal Stability Protects Against Extremes

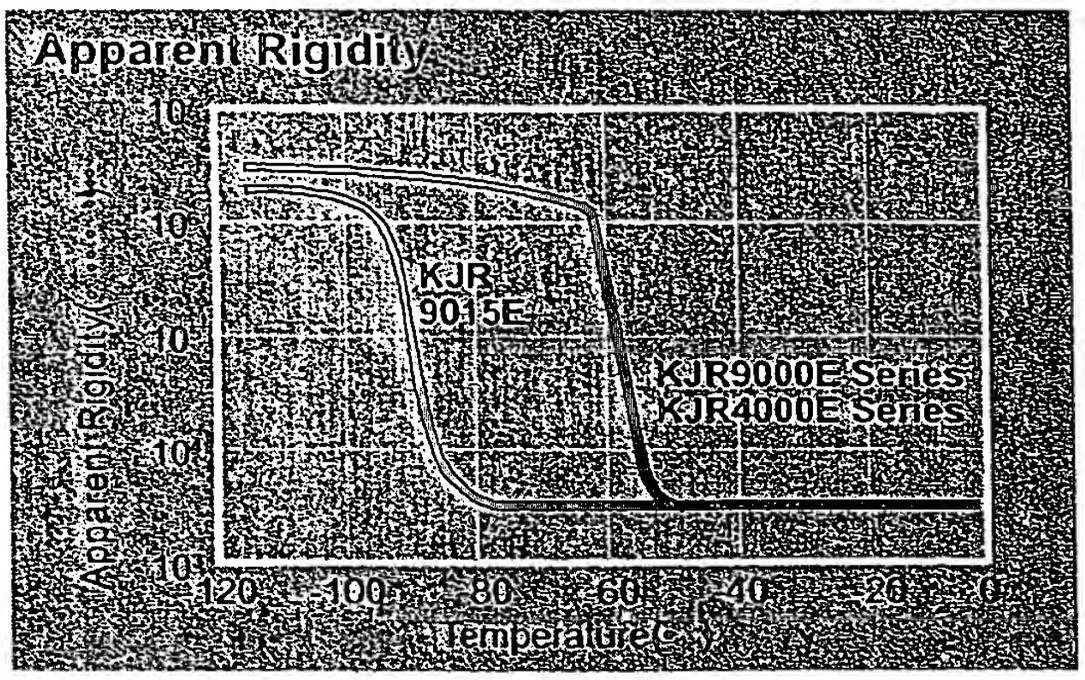
Thermal stability derived from the inherent properties of silicones gives the KJR Series the ability to protect devices from the extremes of heat shock, solder dip and other situations.

The KJR651E with its special copolymer structure is the most stable, capable of withstanding temperatures as high as 250• :



Flexibility Down to • 80• •

KJR9015E maintains its flexibility at temperatures as low as • 80• ; providing an effective buffer against severe thermal shock.



Adhesive Property

Improved Breakdown Voltages with Higher Adhesive Strength

The KJR Series shows a very good affinity for the metallic and ceramic substrates used in semiconductor manufacturing. Higher breakdown voltages and lower leak currents result from the bonding properties of the KJR Series.

Post-curing is recommended to further improve the adhesive strength and stability of KJR Series resins.

• 1 Shear Strength kg/cm²• •

• 2 Area of JCR remaining on substrate after Shear Test percent• •

Adhesive Strength

		Silicon Substrate		Aluminum Substrate	
	GRADE	Strength *1	Residual Area *2	Strength *1	Residual Area *2
Flexible Type	4010E	3	100	3	100
	4012E	3	100	3	100
	4013E	8	100	8	100
	4050E	4	100	3	90
	9010E	4	100	5	100
	9014E	1	100	1	100
	9015E	3	100	3	100
	9022E	8	100	8	100
	9023E	2	100	2	100
	9033E	3	100	3	100
	9050E	4	100	6	100
	9051E	6	100	6	100
	9052E	3	100	3	100
	9060E	10	100	10	100
	9061E	10	100	10	100

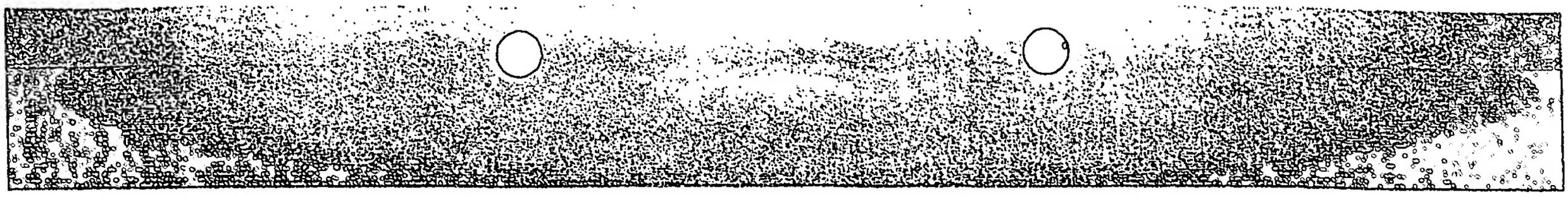
KJR Series

General Properties

Type		Rigid Type							
Item \ Product Name	Unit	KJR651E	KJR653E	KJR654E	KJR4010E	KJR4012E	KJR4013E	KJR4050E	KJR9022E
Component		One	One	One	One	One	One	One	Two
Polymerization		Thermoset	Thermoset	Thermoset	Moisture cure	Moisture cure	Morsture cure	Moisture cure	Thermoset
Appearance		Brown	Brown	Brown	White	Translucent	White	Translucent	Transparent
Non volatile part	%	25	24	19	100	100	100	100	100
Solvent		N-Methyl-2-pyrrolidone	N-Methyl-2-pyrrolidone	Xylene N-Methyl-2-pyrrolidone	None	None	None	None	None
Viscosity 25℃	Poise	20	213	4	30	30	55	350	40
Shelf Life 5~35℃	Month	3	3	3	6	6	6	6	6
Mixing Ration	Base/cure agent								100/10
Pot Life 25℃	Hr								10
Tack Free Time 25℃	Hr								
Cure Condition	Hr	150/1 200/1 250/4	150/1 200/16	150/1 200/1 250/4	25/24 150/4	25/24 150/4	25/24 150/4	25/24 150/4	150/4
Specific gravity					1.05	1.05	1.26	1.05	1.01
Hardness	Shore	80 D	80 D	80 D	22 A	20 A	38 A	18 A	42 A
Tensile Strength	kg/cm²	1,400	800	1,400	15	12	20	17	50
Elongation	%	80			200	200	150	300	150
Adhesive Strength (Silicon)	kg/cm²				3.400	3.400	8.400	12.400	8.400
Adhesive Strength (Aluminum)	kg/cm²				3.90	3.90	8.400	1.90	8.400
Volume Resistivity	Ω·cm	1×10¹⁴	1×10¹⁴	1×10¹⁴	1×10¹⁵	1×10¹⁴	1×10¹⁴	1×10¹⁴	5×10¹⁴
Dielectric Strength	kV/mm	18.0.1mm	10.0.1mm	13.0.1mm	24	22	25	23	25
Dielectric Constant	50Hz	3.1	3.1	3.1	3.0	3.0	3.3	3.0	2.9
Dissipation Factor	50Hz	3.1×10⁻²	3.2×10⁻²	3.1×10⁻²	5×10⁻²	5×10⁻²	3×10⁻²	5×10⁻²	5×10⁻²
Applicable Temperature	℃	-50~300	-50~300	-50~300	-50~200	-50~200	-50~200	-50~200	-50~200

Application	
Diode	
Rectifier	
Thyristor	
Transistor	
Opto Coupler	
LED	
LCD	
Integrated Circuit	
Hybrid IC	

• • •More than 60• Relative Humidity • • Penetration Measure



	Flexible Type								Gel Type			
	KJR9023E	KJR9025E	KJR9033E	KJR9060E	KJR9061E	KJR9050E	KJR9051E	KJR9052E	KJR9010E	KJR9014E	KJR9015E	KJR9017E
	Two	Two	One	One	One	Two	Two	Two	Two	One	Two	One
	Thermoset	Thermoset	Thermoset	Thermoset	Thermoset	Thermoset	Thermoset	Thermoset	Thermoset	Thermoset	Thermoset	Thermoset
	Transparent	Translucent	White	Translucent	Translucent	Black	Gray	Translucent	Transparent	Translucent	Transparent	Transparent
	100	100	100	100	100	100	100	100	100	100	100	100
	None	None	None	None	None	None	None	None	None	None	None	None
	40	70	50	90	170	300	50	90	7	100	8	8
	6	6	3	3	3	6	6	6	6	3	6	3
	100/10	100/100				100/10	100/10	100/10	100/10		100/100	
	24	24				24	24	24	8		8	
	150/4	80/2	150/4	150/4	150/4	150/4	80/2	80/2	150/2	150/2	150/2	150/2
	0.99	1.00	1.0	1.0	1.0	1.04	1.18	1.00	0.97	1.00	0.99	0.99
	22 A	17 A	28 A	18 A	13 A	35 A	40 A	16 A	65	65	65	65
	7	5	5	16		15	15	7				
	150	200	150	600	600	180	150	180				
	2,400		3,400	19,400	10,400	4,70						
	2,400		3,400	19,400	18,400	6,400						
	1.40	5.40	1.40	2.40	2.40	1.40	1.40	15.40	1.40	1.40	1.40	1.40
	23	21	21	24	23	25	28	22				
	28	29	29	28	28	30	30	27	30	30	30	30
	5.40	5.40	4.40	4.40	5.40	5.40	3.40	2.40	4.40	4.40	4.40	4.40
	50.200	50.200	50.200	50.250	50.250	50.200	50.200	50.200	50.200	50.200	80.250	80.250

Inhibitors Against KJR9000E Series

Curability of grade nos. with 9000E Series will decline if catalysts lose their activity by some compounds.

Before using 9000E Series, curing equipment and containers must be washed well and take care of contamination of inhibitors as follows;

Inhibitors

The compounds which will be the inhibitors have atoms of N, P, S, or Sn in their molecules.

N :Amines, Isocyanates, Amides, Nitriles, etc.
P :Phosphines, Phosphoxides, Phosphoric Esters, etc.
S :Mercaptans, Sulfonates, Sulfides, etc.
Sn :Organo-Tin Compounds Chlorides, Esters, etc.• , etc.

Strength of Inhibitors

The order strength of inhibitors as above is P• •S• •Sn, N. Curability of 9000E Series decline if phosphor compounds are contaminated in several ppm.

Moisture

Moisture, other than the above mentioned inhibitors, has influence upon curability of 9000E Series.
So, please use them paying attention to invasion of moisture.

Handling KJR Series Resins

Storage

To prolong shelf-life, store KJR Series resins in a cool, dark place such as a refrigerator• . •The seal of the bottle should be examined and kept tight to reduce the possibility of moisture or contaminants contacting the resins• • particularly with moisture-cure grade resins.

Preparation

Stir KJR Series resins before using to prevent separation. All grades should be deaerated to minimize the risk of air bubbles in the coating. This is especially critical with the two-component variety. Deaeration should be carried out at a vacuum of less than 15mm Hg for approximately 20 minutes.
The resins should be mixed at the prescribed mix ratio, as shown in the selector guide 6ee General Properties• . •

Coating and Curing

During the coating process, dispense the resins mechanically with specially designed dispensing equipment, or manually by syringe. Protect the coatings from contamination due to moisture, ionic materials, and other foreign substances.
Ensure proper ventilation to remove condensation products from the curing oven.

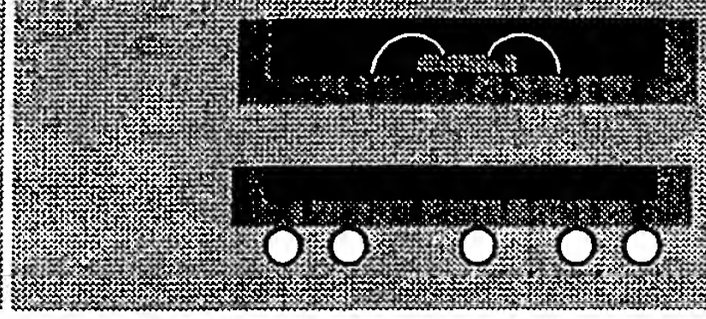
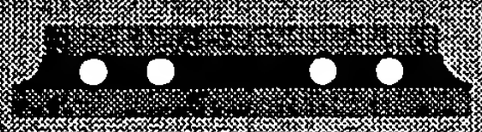
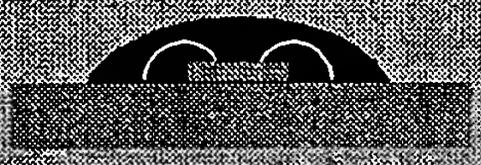
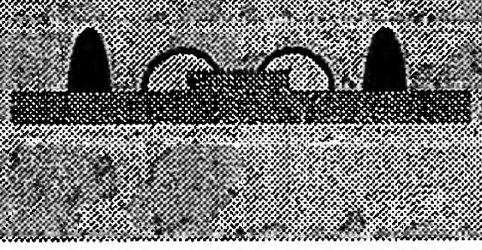
Post Cure

Perform post-cure at approximately 200• •for four to sixteen hours. The post-cure process is essential in improving the resins' passivation quality for all grades with the exception of gel type KJR Series.

SEMICOAT Series

Liquid Epoxy Coating Agents for Semiconductors
One Component Thermosetting Type

Typical Application of SEMICOAT Series for Semiconductors

Application		Product Name
Potting for PGA, BGA etc.		SEMICOAT 114, SEMICOAT 115, X-43-5012A, SEMICOAT 122, SEMICOAT 124
Underfill for Flip Chip		X-43-5107, X-43-5107-1, X-43-5107-2, X-43-5123, X-43-5127
Glob Top for COB		SEMICOAT 220L, 220H, 227, SEMICOAT 120X-1, SEMICOAT 125H
Dam Forming • Bank Agent •		X-43-5255

• UL94V-0 recognized component

SEMICOAT Series

Potting for PGA, BGA etc.

Product Name		SEMICOAT 114	SEMICOAT 115	X-43-6012A	SEMICOAT 122	SEMICOAT 124 *
Feature		Low viscosity	Low viscosity Low stress	Low stress Good Adhesion	Low stress Small warpage	Low stress Flame resistance
Aspect Ratio *		0.10	0.05	0.05	0.05	0.05
ITEM	UNIT					
Appearance		Black	Black	Black	Black	Black
Viscosity 25	poise	55	400	1000	400	900
Gelation Time 150	sec	60	70	70	60	70
Flexural Strength 25	kgf/mm²	8	10	10	11	10
Flexural Modulus 25	kgf/mm²	450	1100	1300	1300	1000
Coefficient of Thermal Expansion 1	ppm/	45	20	15	15	20
Coefficient of Thermal Expansion 2	ppm/	140	80	60	60	80
Glass Transition Temp.		135	145	145	155	145
Volume Resistivity at 25	cm	2×10^{16}	2×10^{16}	2×10^{16}	2×10^{15}	1×10^{16}
Dielectric Constant at 1kHz		4.0	3.5	3.3	3.6	3.5
Recommended Cure Condition		100 /1Hr+ 150 /1Hr	100 /0.5Hr+ 150 /2Hr	100 /0.5Hr+ 150 /2Hr	100 /1Hr+ 150 /2Hr	100 /0.5Hr+ 150 /2Hr
Dispense Condition Device Temp. *		22 60	70 90	70 90	70 90	70 90
Storage Condition		Below 5	Below 5	Below 5	Below 40	Below 5

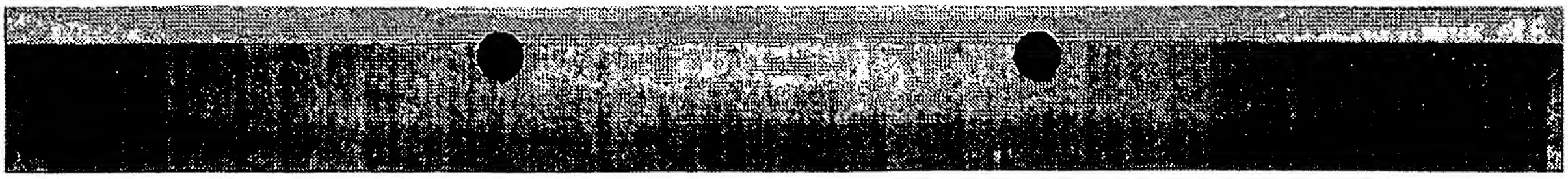
* to avoid trapping air in dispense process.

1 UL94V-0 recognized component

Underfill for Flip Chip

Product Name		Special formulation			Standard type	
		X-43-5107	X-43-5107-1	X-43-5107-2	X-43-6123	X-43-6127
Feature		High reliability Good penetration	High reliability Better penetration	Low viscosity More better penetration	Low viscosity Good penetration	Low viscosity Better penetration
Possible Gap Size	m	20 100	20 100	20 100	40 100	20 100
ITEM	UNIT					
Appearance		Black	Black	Black	Black	Black
Viscosity 25	poise	2500	1000	360	150	80
Viscosity 100	poise	7.8	3.5	1.8	2.0	1.5
Gelation Time 150	sec	330	330	330	75	75
Flexural Strength 25	kgf/mm²	10	10	10	10	10
Flexural Modulus 25	kgf/mm²	800	700	600	650	650
Coefficient of Thermal Expansion 1	ppm/	27	32	38	32	32
Coefficient of Thermal Expansion 2	ppm/	80	91	98	105	105
Glass Transition Temp.		140	140	140	145	145
Volume Resistivity at 25	cm	1×10^{16}	1×10^{16}	1×10^{16}	1×10^{16}	1×10^{16}
Dielectric Constant at 1kHz		3.8	3.8	3.8	3.5	3.5
Recommended Cure Condition		120 0.5 Hr + 150 2Hr			100 0.5 Hr + 150 2Hr	
Dispense Condition Device Temp. *		110 130			80 100	
Storage Condition		Below 5			Below 5	

1 UL94V-0 recognized component



Glob Top for COB(thixotropic type)

Product Name		SEMICOAT 220L	SEMICOAT 220H	SEMICOAT 227	SEMICOAT 120X-1	SEMICOAT 125H-1
Feature		Low thixotropy	Middle thixotropy	High thixotropy	Low stress Middle thixotropy	Flame resistance Middle thixotropy
Aspect Ratio*1		0.14	0.20	0.28	0.18	0.24
ITEM	UNIT					
Appearance		Black	Black	Black	Black	Black
Viscosity 25*	poise	850	900	1000	1100	900
Gelation Time 150*	sec	70	70	70	65	70
Flexural Strength 25*	kgf/mm²	10	10	10	10	8
Flexural Modulus 25*	kgf/mm²	800	800	800	1200	850
Coefficient of Thermal Expansion 1	ppm/*	24	24	24	15	24
Coefficient of Thermal Expansion 2	ppm/*	95	95	95	60	95
Glass Transition Temp.	*	140	140	140	150	145
Volume Resistivity at 25*	* cm	2* 10¹⁵	2* 10¹⁵	2* 10¹⁵	2* 10¹⁵	1* 10¹⁵
Dielectric Constant at 1kHz		3.5	3.5	3.5	3.6	3.5
Recommended Cure Condition		100* /0.5Hr* 150* /2Hr	100* /0.5Hr* 150* /2Hr	100* /0.5Hr* 150* /2Hr	100* /1Hr* 150* /2Hr	100* /0.5Hr* 150* /2Hr
Dispense Condition* Device Temp.*	*	50* 80	50* 80	50* 80	50* 80	50* 80
Storage Condition	*	Below* 5	Below* 5	Below* 5	Below* 40	Below* 5

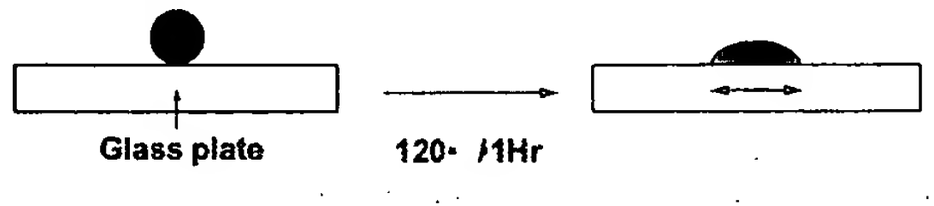
* 4 UL94V-0 recognized component

Dam Forming

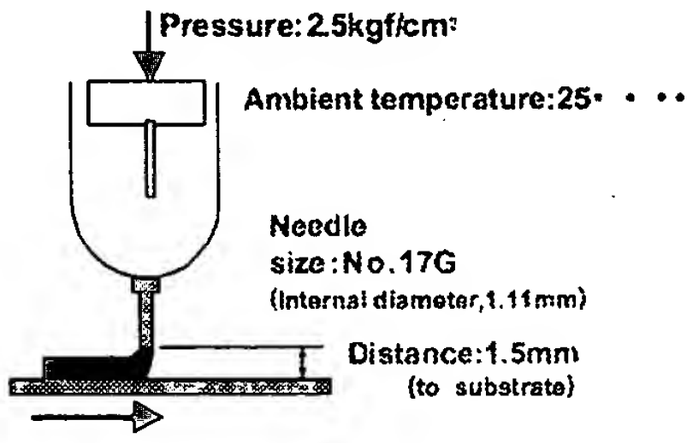
Product Name		X-43-5255
Feature		High thixotropy Good shape retention
Aspect Ratio*		0.75
ITEM	UNIT	
Appearance		Black
Viscosity 25*	poise	7000
Gelation Time 150*	sec	70
Flexural Strength 25*	kgf/mm²	10
Flexural Modulus 25*	kgf/mm²	8000
Coefficient of Thermal Expansion 1	ppm/*	25
Coefficient of Thermal Expansion 2	ppm/*	95
Glass Transition Temp.	*	140
Volume Resistivity at 25*	* cm	2* 10¹⁵
Dielectric Constant at 1kHz		3.5
Recommended Cure Condition		100* /0.5Hr* 150* /2Hr
Dispense Condition* Device Temp.*	*	22* 50
Storage Condition	*	Below* 5

* Measurement Method*

* 2 0.1 g sample dropped



* 8

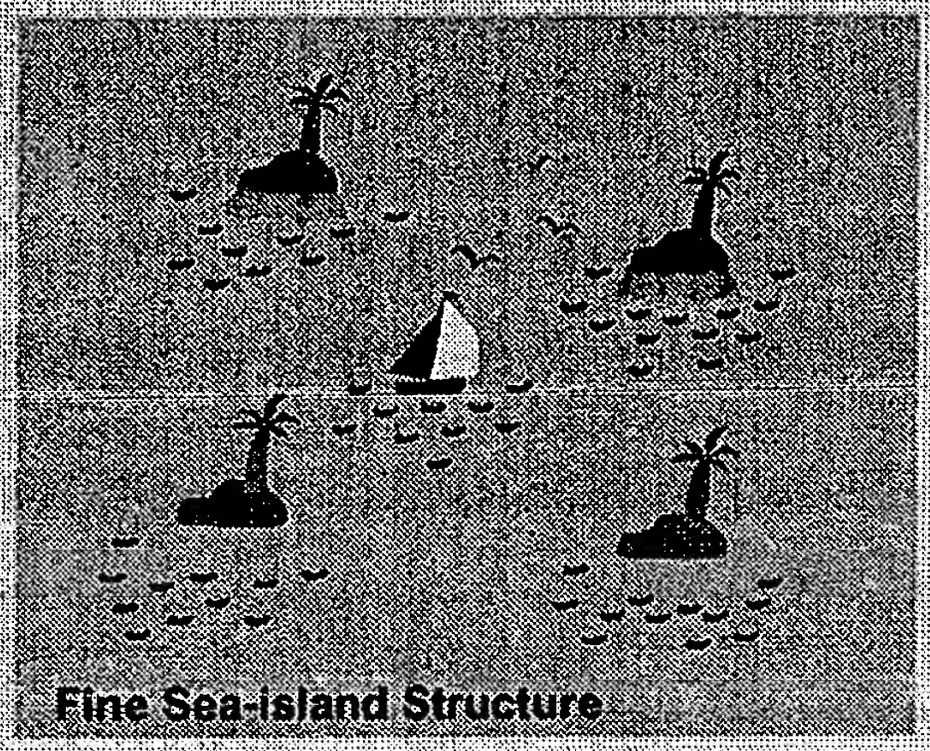


Sweeping speed: 1.5mm/sec

SEMICOAT Series

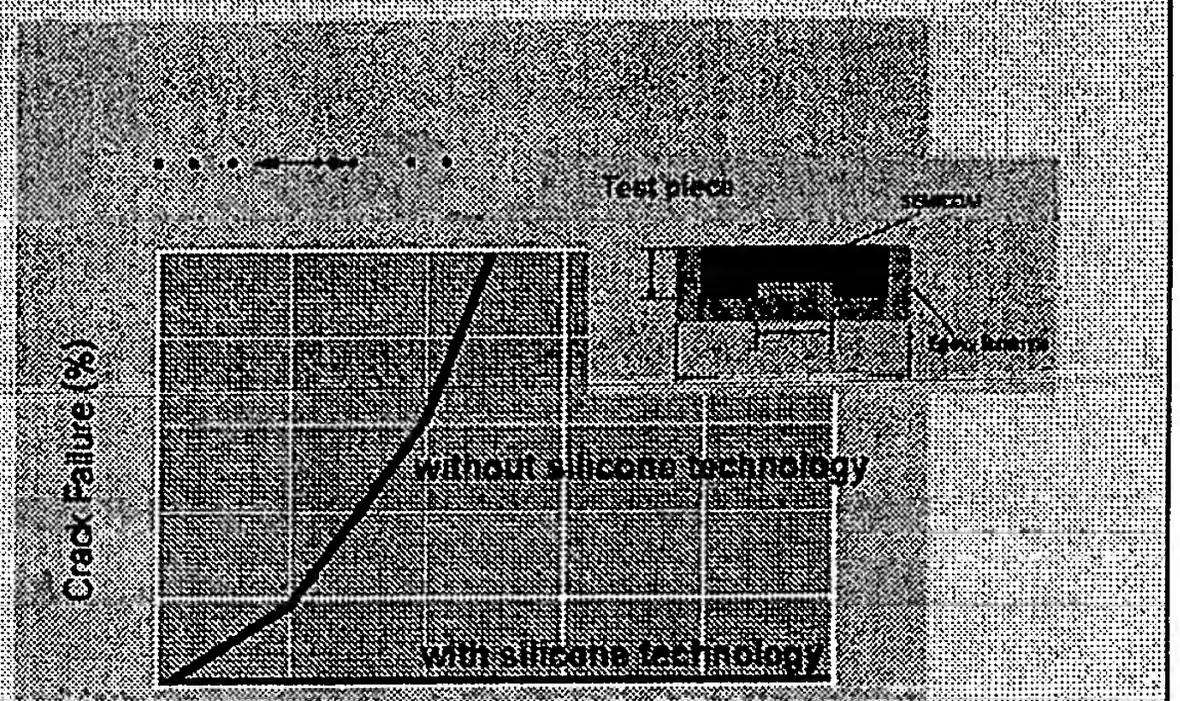
Distinction of SEMICOAT• • •Low Stress Performance

Security as great as the number of islands in the sea • • ••
This is the Shin-Etsu fine sea-island structure



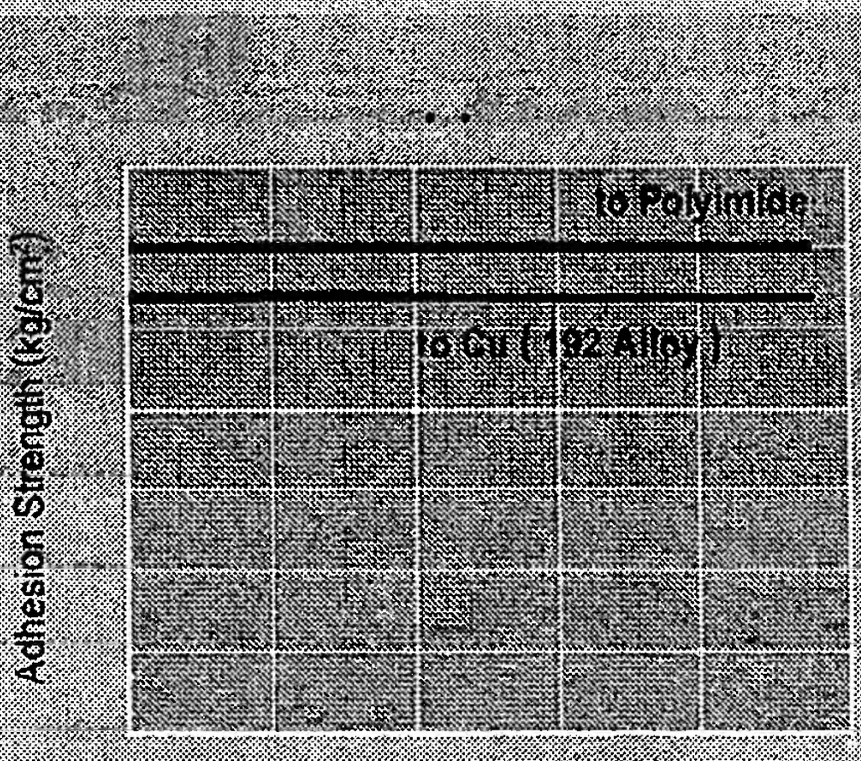
Fine Sea-island Structure

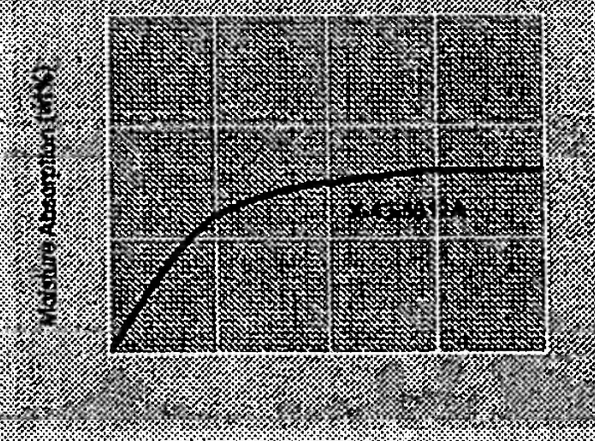
Fine sea-island structure means, just like islands in the sea, silicone is dispersed equally in epoxy resin.
If there is distortion, that silicone islands will absorb it.

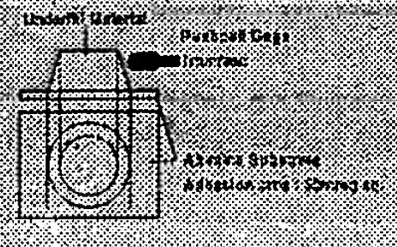


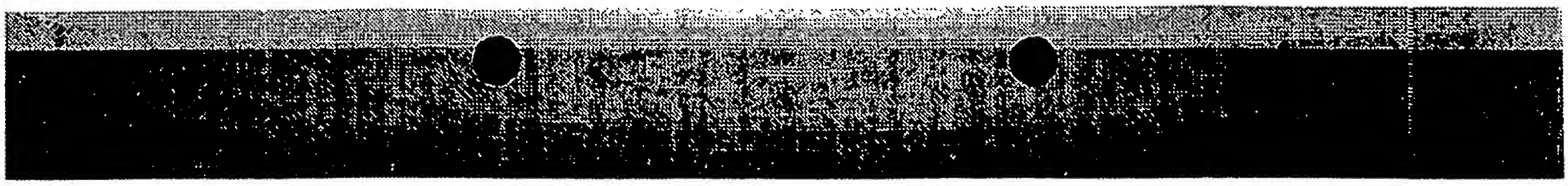
Potting

X-43-5012A ·· Excellent Adhesion Property (Less Sensitivity to Moisture)





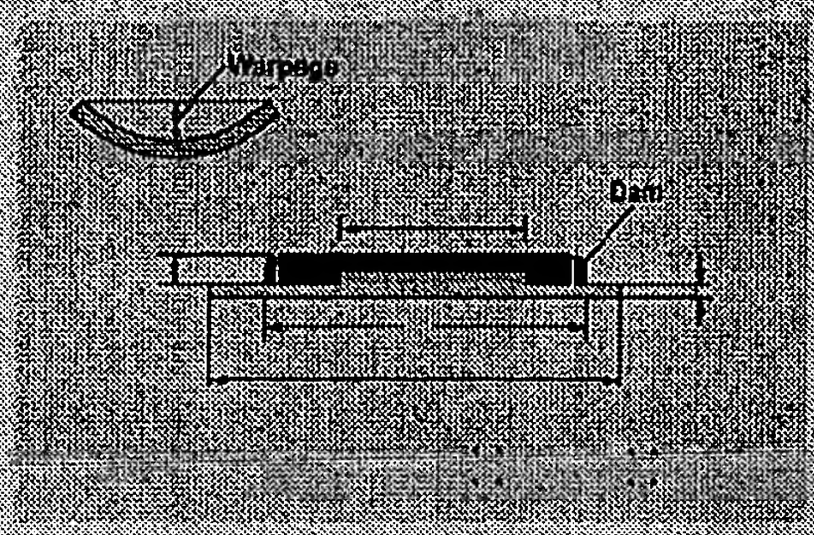




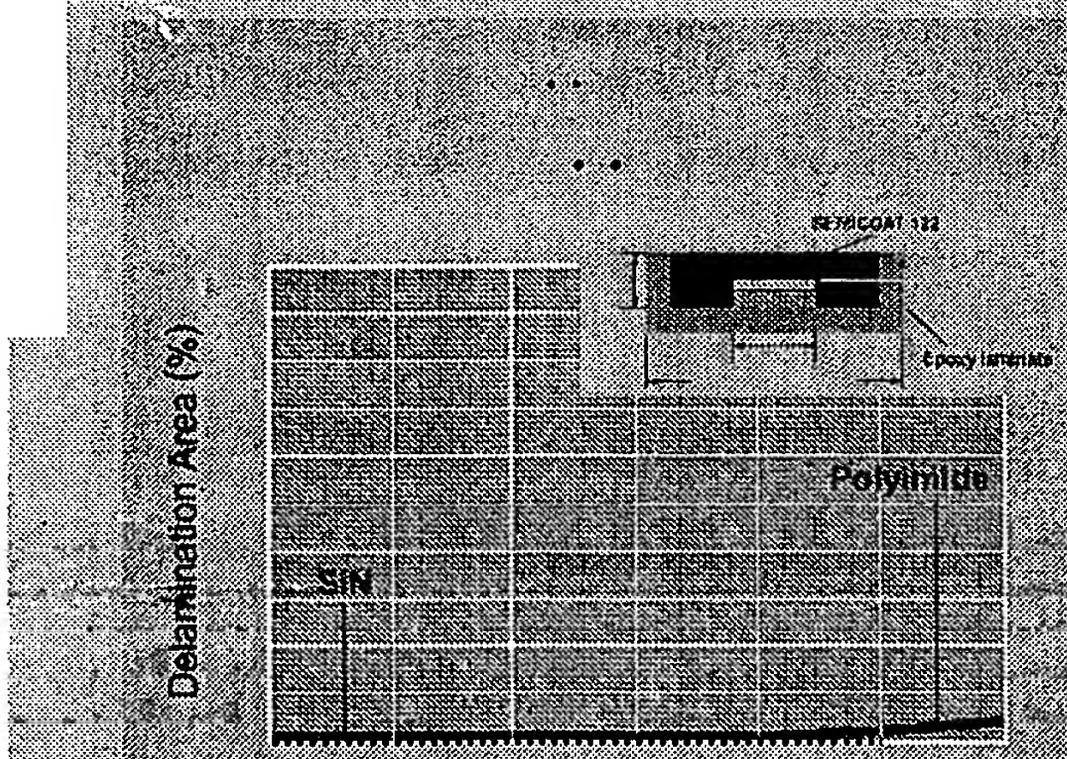
SEMICOAT 122

Small Warpage

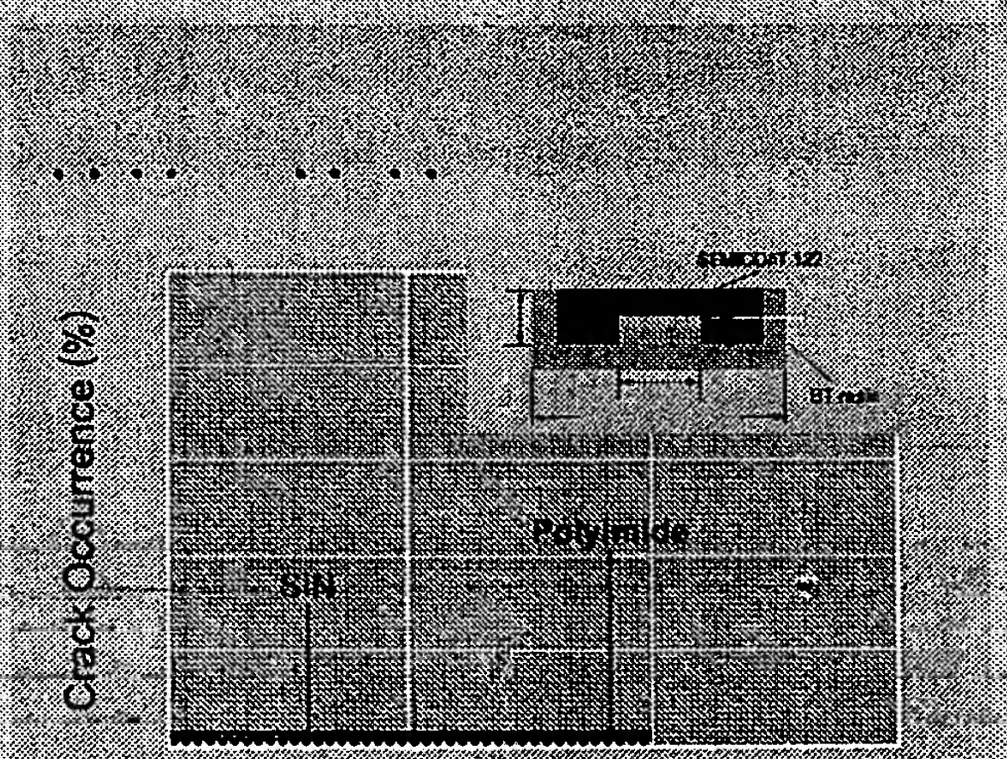
Test Device	Cure Condition	Warpage • m•
A	100• /1Hr• 450• /2Hr	150
A	90• /3Hr• 450• /2Hr	60
B	90• /3Hr• 450• /2Hr	30



Good Adhesion to Organic and Inorganic Layer



Excellent Crack Resistane



Popcorn Resistance

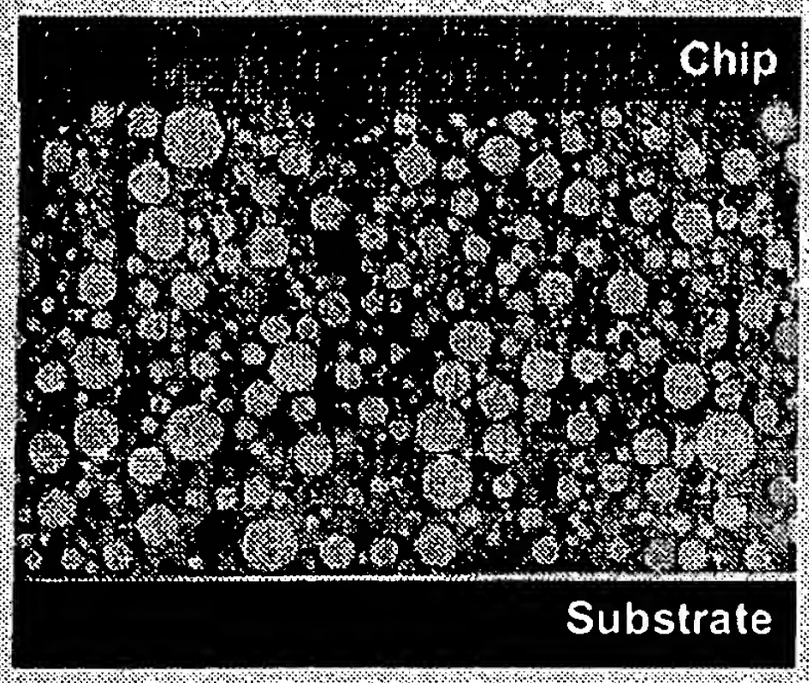
Pass JEDEC Level 3 test.

with 35mm sq. BGA device

1. Encapsulated devices are exposed to 30• /60• RH for 192Hr.
2. Devices undergo IR reflow Max 240• •.•
3. Crack occurrence is checked at the interfacial layer between Polyimide and SEMICOAT.

Underfill

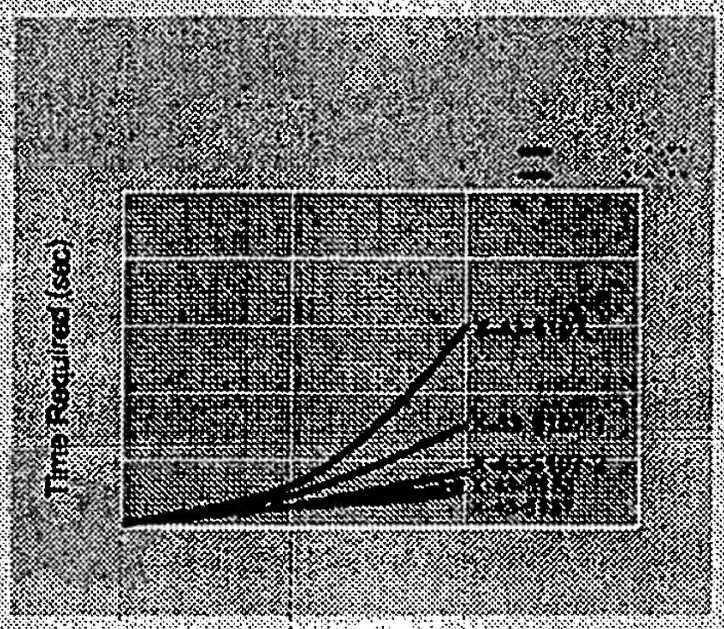
No Filler Settling



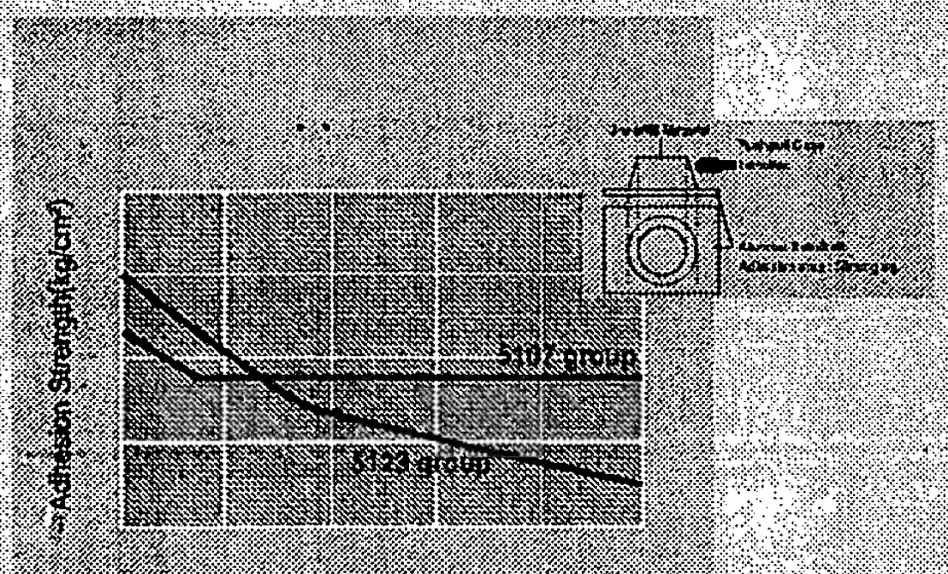
5107 cure condition• 120• /0.5Hr• 150• /2Hr• •

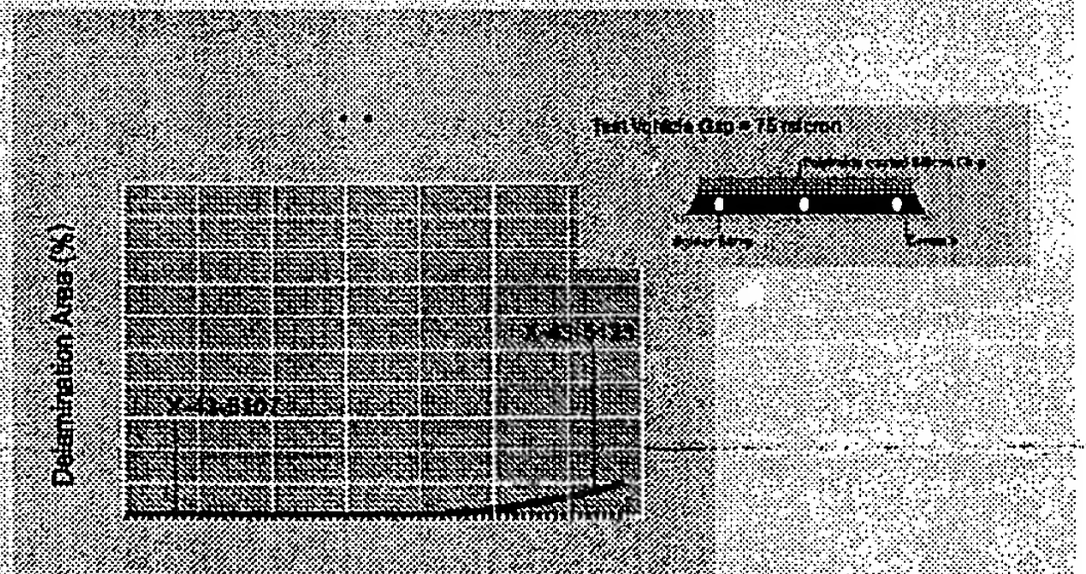
5123 cure condition• 100• /0.5Hr• 150• /2Hr• •

Penetration Speed



Excellent Adhesion Property (Less Sensitivity to Moisture)





Dam Forming

Make a Shape Control Easy

- Eliminated Cure Process for Dam Forming• •

Both dam forming agent and potting material can be cured at the same time.
The cure process for dam forming agent is no need, because of its less shape change that might happen between dispense and post cure.

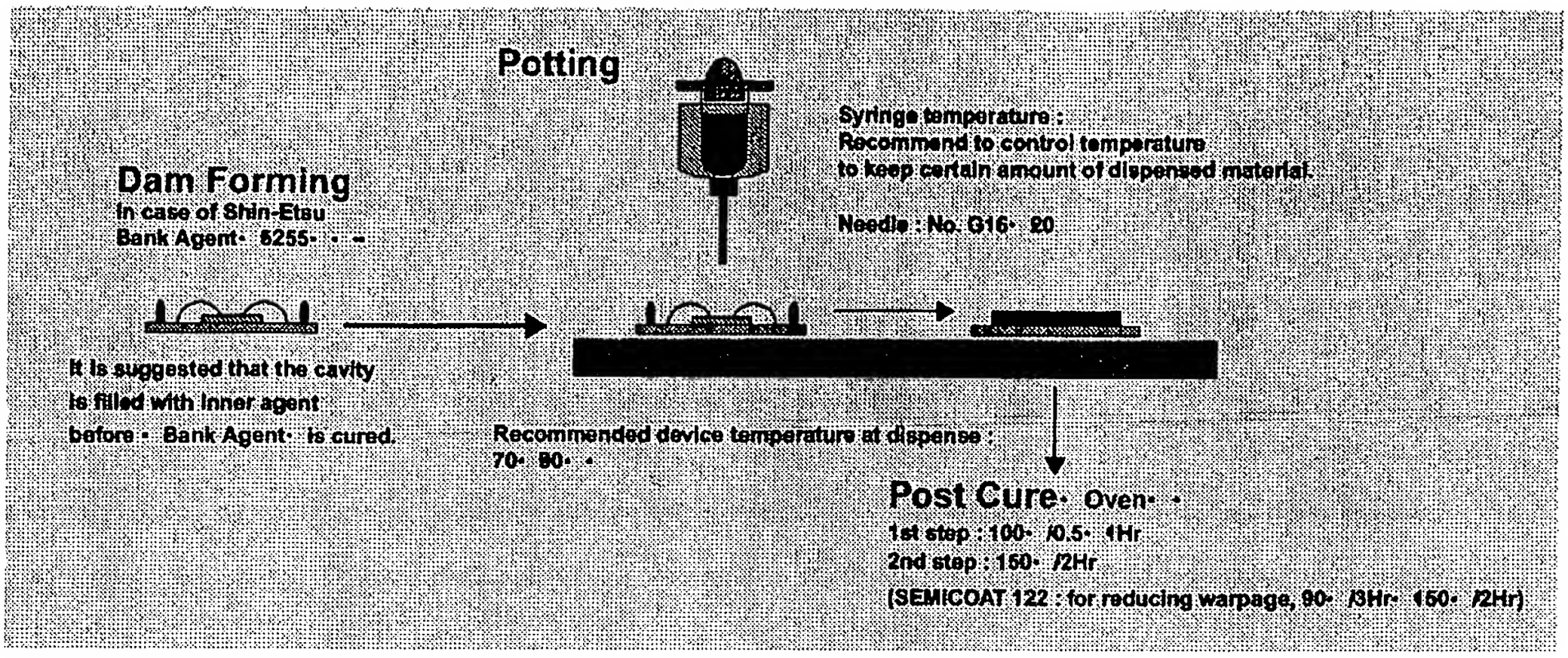
Ex

Dam Forming
• 5255 dispense• •

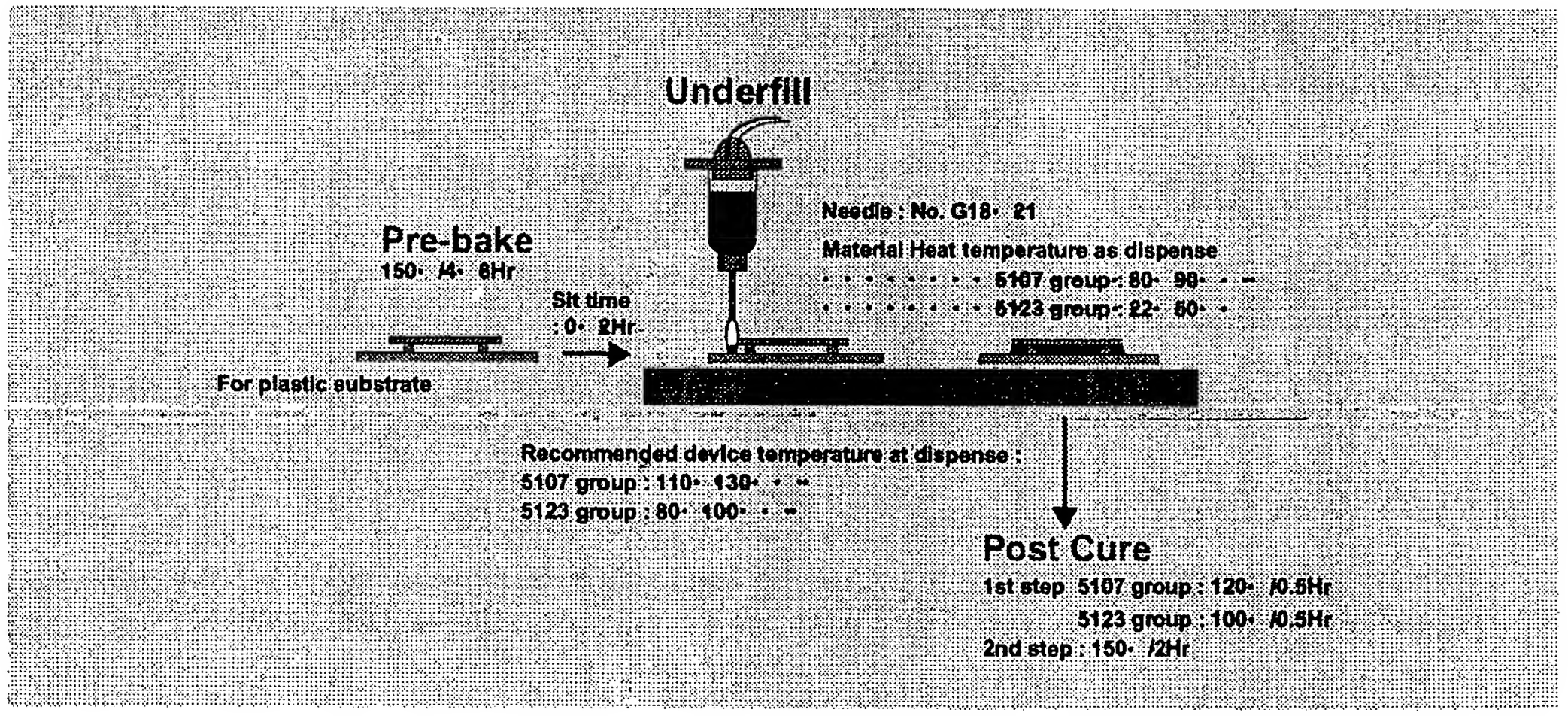
Potting
• 4115 dispense• •

Cure

How to Use Potting and Dam Forming Agent



How to Use Underfill



Handling

Prior to using the product, remove it from cold storage and return it to ambient temperature.

Keep the product and assembled device dry for optimum performance. Moisture contamination may cause voids and degrade other important characteristics.

For safe handling, avoid skin contact and breathing vapor or dust during the use of this product. It is recommended to wear proper safety gears. If skin contact occurs, wash thoroughly with soap and water.

For details, please refer to MSDS.